February 2021

Binder 016, Azygiidae [Trematoda Taxon Notebooks]

Harold W. Manter Laboratory of Parasitology

Leuceruthrinae Goldberger, 1911

Subfamily diagnosis. — Azygiidae: Body tongue-shaped, smooth. Oral sucker large, acetabulum small, in middle third of body. Ceca terminating at posterior extremity. Testes diagonal, postacetabular. Cirrus pouch small, preacetabular. Ovary median, in posterior third of body. Vitellaria extending nearly whole length of hindbody. Uterus coiled in intercecal field between ovary and acetabulum, passing between two testes. Excretory vesicle Y-shaped.

Leuceruthrus Marshall et Gilbert, 1905

Generic diagnosis. — Azygiidae, Leuceruthrinae: Body tongue-shaped, smooth. Oral sucker subterminal, large, surmounted by pre-oral lobe; pharynx well developed; esophagus nearly lacking; ceca terminating at posterior extremity. Acetabulum smaller than oral sucker, pre-equatorial. Testes diagonal, postacetabular. Copulatory apparatus present. Genital pore a little in front of acetabulum. Ovary median, about midway between testes and posterior extremity. Vitellaria occupying greater part of lateral fields of hindbody. Uterus closely coiled between ovary and acetabulum, passing between two testes. Excretory stem reaching to ovary. Parasitic in stomach of freshwater fishes.

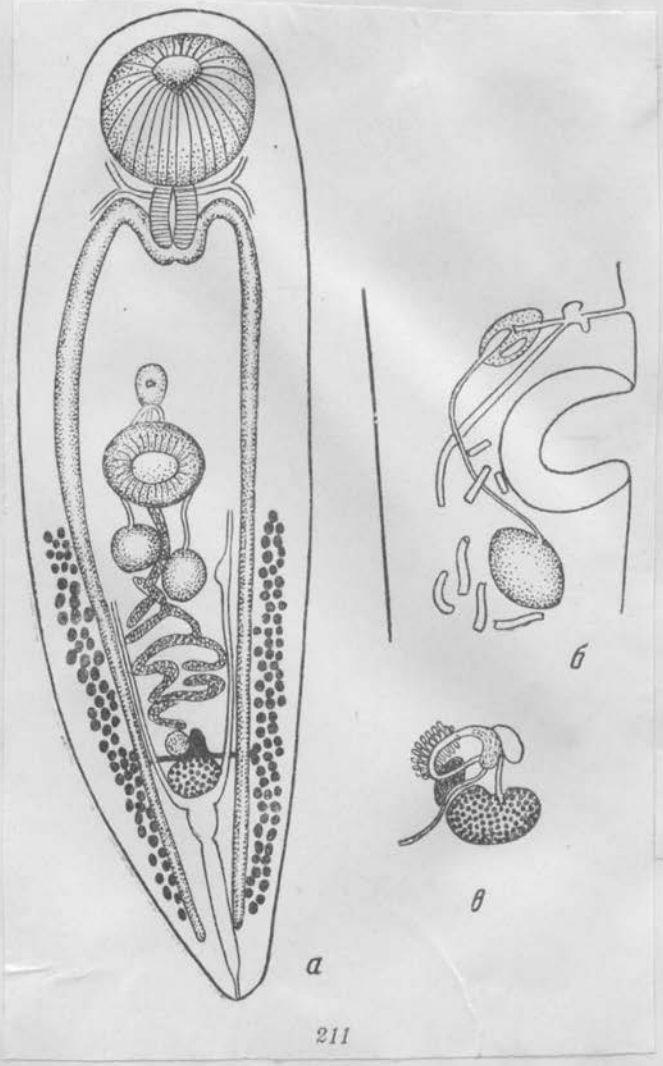
Genotype: *L. micropteri* Marshall et Gilbert, 1905 (Pl. 15, Fig. 183), in *Micropterus salmoides*, *M. dolomieu* and *Amia calva;* U.S.A.

Leuceruthrus micropteri Marshall et Gilbert, 1905

(Рис. 211—212)

Хозяева: рыбы — *Micropterus salmoides, M. dolimieu, Amia calva.*
Локализация: рот и желудок.
Место обнаружения: США.

FROM SKRJABIN, VOL. 14

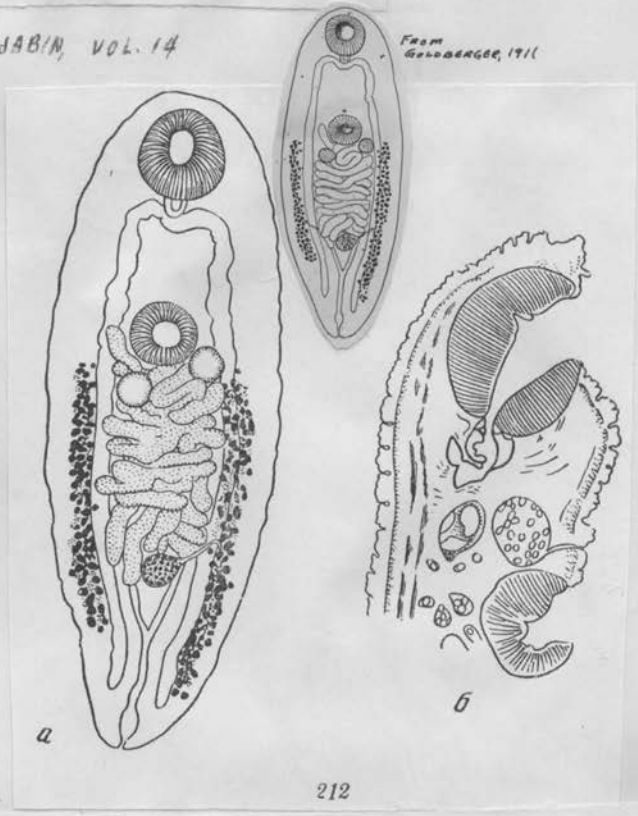


211

211. *Leuceruthrus micropteri* Marshall et Gilbert, 1905 (по Маршаллу и Гильберту, 1905)

а — общий вид мариты; *б* — выводные протоки половых желез; *в* — схема женской половой системы

From Goldberger, 1911



212

212. *Leuceruthrus micropteri* Marshall et Gilbert, 1905 (по Гольдбергеру, 1911)

а — марита; *б* — сагиттальный срез в области половой бурсы

Otodistomum Stafford, 1904

Syn. *Xenodistomum* Stafford, 1904

Generic diagnosis. — Azygiidae, Azygiinae: Body fusiform to flattened cylindrical, with smooth cuticle. Oral sucker subterminal, surmounted by preoral lobe. Pharynx rather small, esophagus very short or practically lacking, ceca somewhat sinuous, terminating at posterior extremity. Acetabulum larger than oral sucker, near anterior extremity. Testes tandem or somewhat diagonal, close together in middle third of body. Cirrus pouch pre-acetabular, enclosing seminal vesicle and prostatic complex. Genital cone or papilla containing ejaculatory duct and metraterm, projecting into genital atrium. Genital pore nearer to oral sucker than to acetabulum. Ovary submedian, immediately pretesticular. Uterus forming close intercecal coils between ovary and acetabulum. Vitellaria extending along ceca from a short distance in front of ovary to some distance back of posterior testis. Excretory stem bifurcating behind posterior testis; arms united over oral sucker. Parasitic in digestive tract of skates and sharks.

Genotype: *O. veliporum* (Crepl., 1837) Stafford, 1904, [1]) syn. *Distoma insigne* Dies., 1850 (Pl. 15, Fig. 189), in *Squalus griseus*. Also in *Raja laevis;* Canada. Metacercaria encysted in *Chimaera monstrosa* — Dollfus (1937). Additional hosts — Dollfus (1937). Key to species — Dollfus (1937).

Other species:

O. cestoides (van Beneden, 1870), syn. *Xenodistomum melanocystis* Stafford, 1904 — Linton 1940, in *Raja batis;* Belgium. Also in *Raja stabuliformis* (= *R. laevis*), *R. fullonica*, *R. lintea*, *R. clavata*, *R. radiata*, *R. macrorhyncha*, *Chlamydoselache anguinea*. Additional hosts and distribution — Dollfus (1937), Linton (1940). Two subspecies of Dollfus (1937), *cestoides* for *Distomum veliporum* of Sleggs, 1927, and *pacificum* for *Otodistoma* [*veliporum*] of Manter, 1926, are merged by Van Cleave and Vaughn (1941) in *O. cestoides*.

O. plicatum Kay, 1947, in *Hexanchus griseus;* Friday Harbor, Wash.

O. plunketi Fyfe, 1953, in *Scymnodon plunketi;* New Zealand.

O. pristiophori (Johnston, 1903) in *Pristiophorus cirratus;* Australia.

O. scymni (Risso, 1826) emend. Monticelli, 1892, in *Echinorhinus bruchus*, Finistère; *Centroscymnus coelolepis;* Golfe de Gascogne.

O. veliporum leptotheca Dollfus, 1937, for *Distoma insigne* Dies. of Villot, 1878; syn. of *O. scymni* — Guiart, 1938, in *Torpedo marmorata*, French West Africa; *Echinorhinus spinosus*, Roscoff.

O. veliporum pachytheca Dollfus, 1937, in *Torpedo narce*, Côte de Mauritanie; *T. marmorata*, Côte atlantique du Maroc.

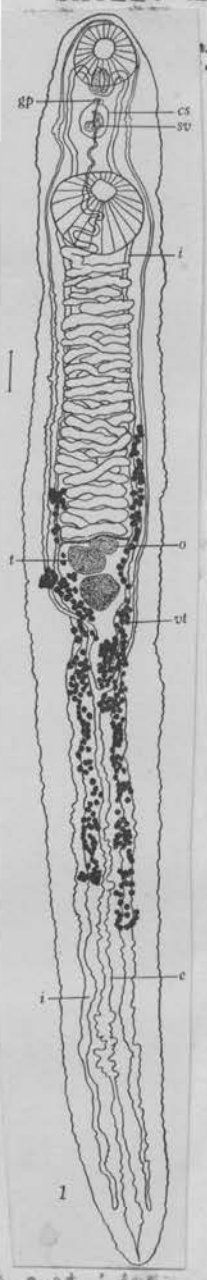
O. veliporum veliporum Dollfus, 1937, in *Hexanchus griseus;* Arcachon.

[1]) *Otodistomum veliporum* of Stafford is regarded by Linton (1940) and Miller (1941) as a synonym of *O. cestoides* van Beneden.

OTODISTOMUM Stafford 1904

Body very elongate, moderately flattened, equally wide hindbody. Excretory vesicle with long stem which forks behind the testes with branches uniting in front of the oral sucker. Genital pore near the oral sucker. Genital sinus very long and wide, tube-like. At its base their extends up a genital papilla at the point of which the sex ducts open thru a common tube. Pars prostatica and seminal vesicle surrounded by an ellipsoid cirrus sac located between pharynx and ventral sucker and provided with a well developed muscular coat. The seminal vesicle lies in its base and is almost uncoiled. Following it there is a long pars prostatica which runs backward to form a bow. Into this open a glandular mass which fills most of the cirrus sac. This passes at the anterior end of the cirrus sac into a distally slightly coiled ductus ejaculatorius which is surrounded by a relatively very thick layer of muscles, inner longitudinal and outer circular fibers. Ovary and testes globular ordinarily a little in front of midbody. Vitellaria ####### ###### ### ######## beginning between testes and ventral sucker and extend more or less behind the testes. Vagina wide with exceptional powerful musculature, reaching to the hind end of the ventral sucker. Eggs 65 to 85 u long with very solid shell. Miracidium unciliated. In Selachians. (Mostly after Odhner

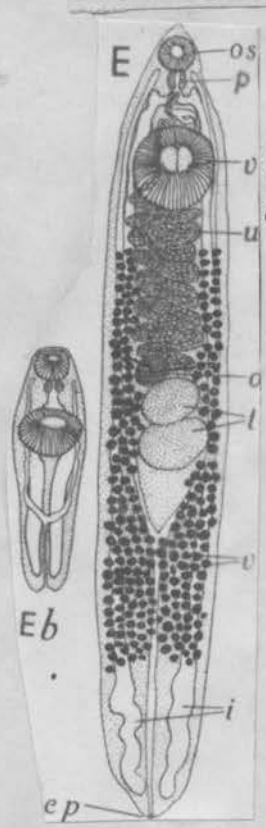
Type species: Otodistomum



O. cestoides.

← Manter, 1926

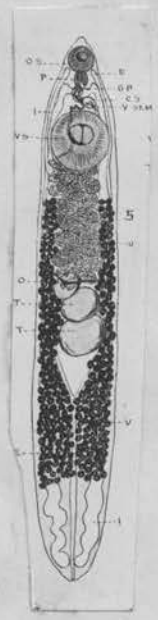
Eggs averaging about 69 by 46μ.....*O. cestoides*
Eggs averaging about 86 by 58μ.....*O. veliporum*



O. CESTOIDES (AFTER LEBOUR, 1908)

Eb JUV. (AFTER NICOLL, 1913

FROM DAWES, 1946 THE TREMATODA



O. veliporum from Lebour 1908

Otodistomum veliporum (Creplin, 1837) Stafford, 1904

(Рис. 200—202)

Синонимы (из Дауэса, 1946): *Distoma veliporum* Creplin, 1837; *Distoma insigne* Diesing, 1850; *Fasciola squali grisei* Risso в понимании Diesing, 1850; *Distoma microcephalum* Baird, 1853; *Distoma cestoides* Beneden, 1876; *Distomum nigrescens* Olsson, 1876; *Agamodistomum chimaerae* Ariola, 1899; *Xenodistomum melanocystis* Stafford, 1904; *Otodistomum cestoides* (Beneden, 1870); *Cercaria cestoides* Nicoll, 1913; *Otodistomum cestoides cestoides* Dollfus, 1937; *Otodistomum cestoides pacificum* Dollfus, 1937; *Otodistomum veliporum pachytheca* Dollfus, 1937; *Otodistomum veliporum leptotheca* Dollfus, 1937; *Xenodistomum melanocystis* Stafford, 1904

Хозяева: рыбы—*Raja batis*, *Raja binoculata* (=*R. stabuliforis* = *R. laevis*), *Raja fullonica*, *Raja lintea*, *Raja clavata*, *Raja radiata*, *Raja diaphanes*, *Raja macrorhyncha*, *Chlamydoselachus anguineus*, *Lophius piscatorius*, *Carcharias rondeletti*, *Carcharias* sp., *Notidanus griserus*, *N. cinereus*, *Echinorhinus spinosus*, *Squalus acanthias*, *S. griseus*, *Ceratacanthus schoepfi*, *Patinurichthys perciformis*, *Scymnus nicaensis*, *Acanthias vulgaris*, *Laemargus melanostoma*, *Scyllium canicula*, *Chimaera monstrosa*, *Centrolophus pompilus*.

Локализация: желудок, редко пищевод, кишечник.

Места обнаружения: СССР, Средиземное море, Атлантический океан, Англия, Бельгия, Франция, Италия, Швеция, Норвегия, некоторые районы американского континента (Мэйн, Вудс-Холл, Вашингтон, Калифорния, Канада, Аляска, Чили), Новая Зеландия.

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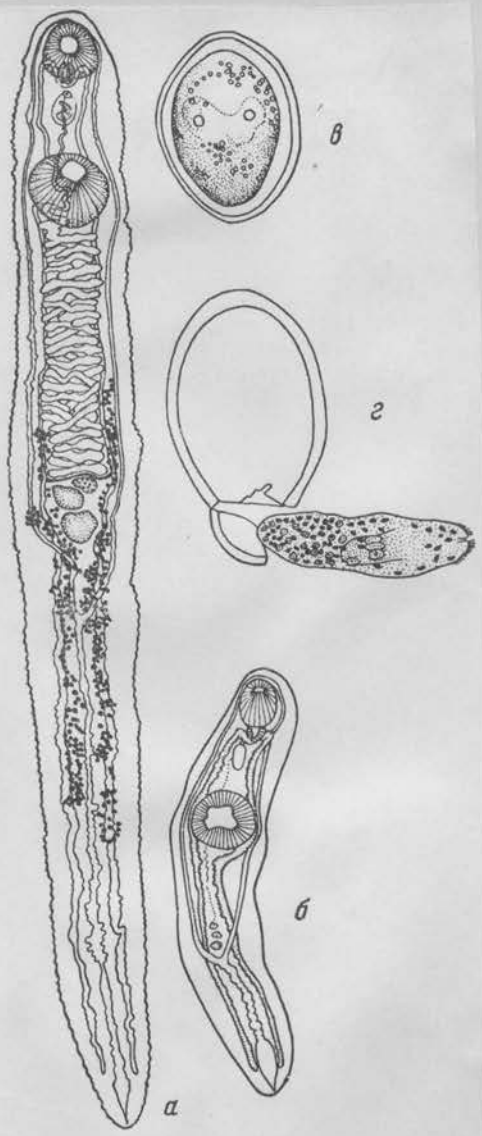
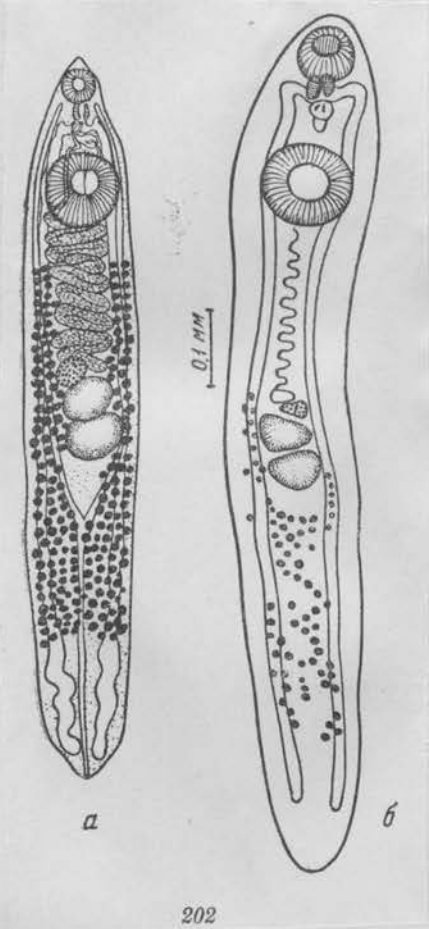


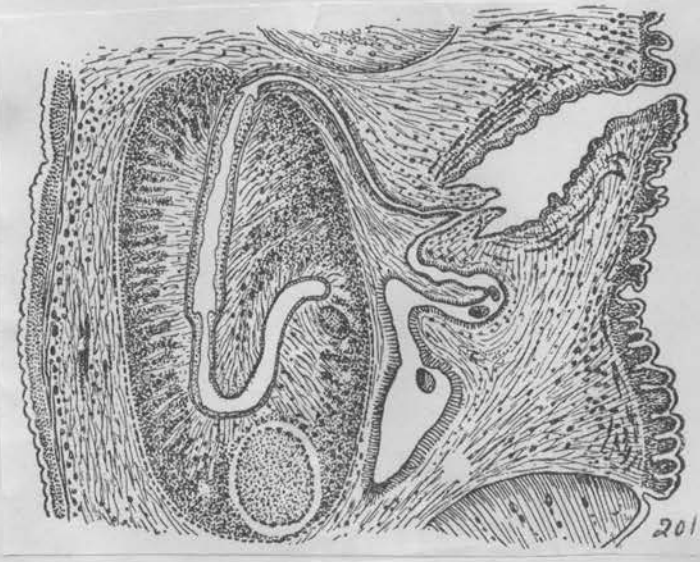
200

200. *Otodistomum veliporum* (Creplin, 1837) (по Мантеру, 1926)
а — марита; *б* — незрелый экземпляр; *в* — яйцо; *г*—мирацидий, выходящий из яйца



202

202. *Otodistomum veliporum* (Creplin, 1837)
а — по Лебур, 1908, из Дауэса, 1946; *б* — по Миллер, 1941



201

201. *Otodistomum veliporum* (Creplin, 1837) (по Однеру, 1911)
Продольный срез концевого участка полового аппарата (схема)

Otodistomum veliporum (Creplin, 1837) Stafford, 1904
(Fig. 1, 2)

Hôte — *Squatina californica* Ayres, 1859 (Elasmobranchii: Squatinidae). *Localisation* — Estomac. *Localité géographique* — Long Beach Harbor ~~County~~, Californie et ~~le~~ Segundo, Californie, USA. Exemplaires dans la Collection Helminthologique de E. Caballero y C. No. 498 et dans le Laboratoire d'Helminthologie de l'Institut de Biologie de l' U.N.A.M. 223-9.

Le matériel d'étude pour la redescription suivante consiste de cinq exemplaires mûres dont quatre ont été recuellis dans l'intestin grêle de *Squatina californica* Ayres, 1859 (Elasmobranchii) à Long Beach, Harbor County, Californie, USA, le 5 avril, 1956, et l'autre chez la même espèce d'hôte saisit en le Segundo, Californie, USA, le 19 juin de la même année. Ces spécimens portent les numéros 5 et 6 de la Collection Winter.

Description — Corps sub-cylindrique, aplati dorsoventralement, long de 40 mm, large de 4.909 mm au niveau de l'acetabulum; les extrémités sont légèrement arrondies, la postérieure étant plus large que l'antérieure. Cuticule épaisse et sans épines.

La ventouse buccale est subterminale, mesurant 1.409 mm de diamètre longitudinal sur 1.458 mm de diamètre transversal. Antérieurement elle est limitée par une région pré-orale de forme conique. L'acetabulum de 2.349 mm de longueur sur 2.673 mm de largeur est situé à 6.765 mm du bord antérieur du corps. Le rapport ventouse buccale/ventouse ventrale est de: 1:1.6 × 1:1.8, en prenant comme unité la ventouse buccale.

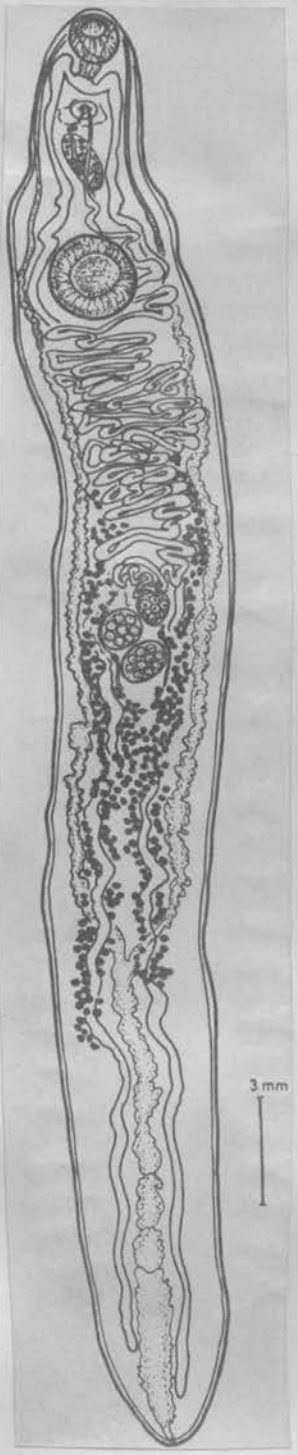
La bouche, ouverture ample, donne accès au pharynx, à travers d'un entonnoir buccal; le pharynx est grand et musculeux, long de 0.648 mm, large de 0.583 mm. Pas d'oesophage. La bifurcation intestinale se trouve à la continuation du pharynx; les caeca à bords lisses, légèrement sinueux dans toute sa longueur, se terminent dans l'extrémité postérieure du corps. Antérieurement ces caeca s'introduisent dans l'espace comprit entre le pharynx et les tubes excréteurs.

Appareil génital mâle — Les testicules sont sphériques ou bien sub-sphériques, aux bords complets, en position pré-équatoriale, intercaecaux et obliques; au devant sont limités par l'ovaire et par les premières anses utérines, latéralement par les caeca et par les glandes vitellogènes et postérieurement par d'abondants follicules vitellogènes. Le testicule antérieur situé à droite, est 1.264 mm de long sur 1.150 mm de large; le testicule postérieur, situé à gauche, est 1.442 mm de long sur 1.199 mm de large. Le vase déferent est nettement visible dans sa partie terminal au moment de se mettre en contact avec la poche du cirre. Cette dernière est petite, oblique, étalée entre l'acetabulum et la bifurcation intestinale, est 1.620 mm de long sur 0.810 mm de large. Le tiers inférieur de la poche du cirre est ocuppé par la grosse vesicule séminale, qui alors rétrécit afin de former le canal éjaculateur, lequel quitte la poche du cirre et se termine dans l'atrium génital. Glande prostatique bien developpée.

Appareil génital femelle — L'ovaire subsphérique, intercaecal, est situé à gauche du testicule antérieur, est 0.907 mm de long sur 0.842 mm de large. Pas de réceptacle séminal. L'utérus s'étend vers la région antérieure en multiples anses transversales post-acetabulaires bien définies, la dernière suit le bord latéral gauche de l'acetabulum à l'aide de courtes anses, trouve la poche du cirre, la croise soit dorsalement, soit ventralement, s'ouvrant finalement dans l'atrium. L'atrium génital est situé à 2.349 mm du bord antérieur du corps. Les nombreux oeufs, jaunâtres à coques épaisses, ont 0.107 mm de long sur 0.073 mm de large.

Les glandes vitellogènes consistent de multiples petits follicules, longs de 0.111 mm, larges de 0.122 mm, distribués dans les régions extracaecaux et post-testiculaire, d'après la région préovarienne jusqu'à la vésicule excrétrice.

Le pore excréteur est subterminal; la vésicule excrétrice très longue, se divise en deux branches extracaecales en parcourant le corps du parasite jusqu'à la ventouse oral; les deux branches s'unissent par devant dans la petite région pré-orale de forme conique.

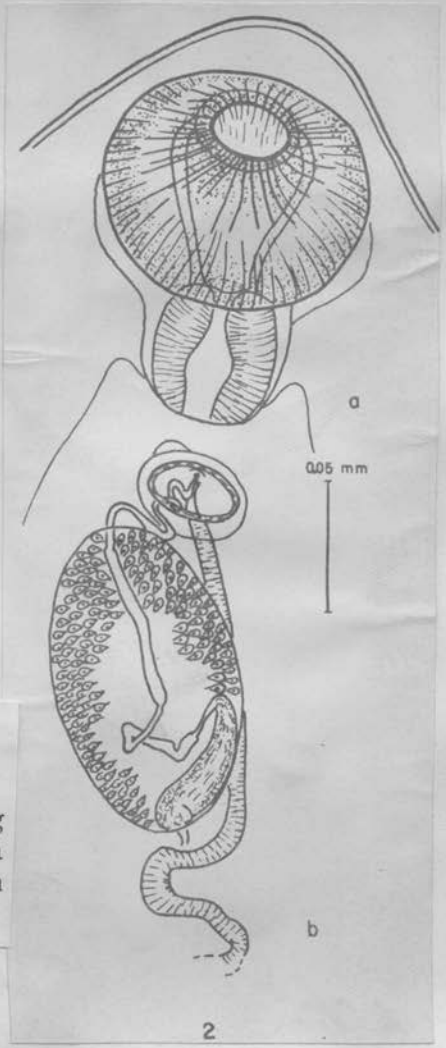


- OVER -

Discussion — Le genre *Otodistomum* Braun, 1899, possède des espèces qui parasitent les Elasmobranchii marins. Il a été le sujet d'un grand nombre d'études, à partir de celle de P. J. van Beneden (1871) jusqu'à la plus récente, celle de K. I. Skrjabin et L. J. Gushanskaya (1958).

Quelques helminthologistes n'acceptent qu'une seule espèce, tandis que d'autres considèrent l'existance de plusieures espèces. R. Ph. Dollfus (1936) accepte plusieures sous-espèces et les auteurs nord-américains (H. J. Van Cleave et Ch. M. Vaughn, 1941; H. W. Manter, 1926; M. J. Miller, 1941) considèrent qu'il existe deux espèces différentes: une dans l'Océan Atlantique et une autre dans l'Océan Pacifique. Le critère accepté pour distinguer les différentes espèces ou sous-espèces est la taille des exemplaires et surtout la disposition des anses utérines. Pour déterminer les exemplaires étudiés ici-même nous avons, par contre, suivi principalement l'analyse des structures morphologiques dont nous déduisons que les exemplaires parasites de *Squatina californica* Ayres, 1859, appartiennent à *Otodistomum veliporum* (Creplin, 1837) Stafford, 1904.

FROM CABALLERO AND CABALLERO, 1969



2

Otodistomum veliporum (Creplin, 1837) Stafford, 1904

Host and locality : intestine of *Dalatias licha*, Stn. 1. Bay of Biscay

This trematode has been reported from this host by a number of authors, including Dollfus (1937) who records it from the Bay of Biscay, off Biarritz, and also gives a list of previous records. Since then it has been found in this host in Norwegian waters by Bråten (1964) and in the Cook Strait, New Zealand, by Manter (1954).

FROM BRAY, 1973

Schell, 1972

Azygiidae

Otodistomum hydrolagi
(Figs. 1–4)

Body light green when alive, fusiform, flat, muscular, nonspinous, 25 long by 10 wide. Oral sucker subterminal, round in ventral view with a diameter of 2; ventral sucker located 5 from anterior end of body, round, with a diameter of 3. Pharynx 0.93 long by 0.6 wide; prepharynx and esophagus absent. Intestinal ceca sinuous, irregular in outline, ending blindly at posterior end of body. Cirrus sac anterior to ventral sucker, oval, 1 long by 0.7 wide, contains curved seminal vesicle and looped prostatic duct; prostatic cells inconspicuous, restricted to widened portion of duct; ejaculatory duct sinuous, extending from cirrus sac to tip of fleshy genital cone; cirrus absent. Testes in mid-body region, opposite, triangular in ventral view, 0.8 long by 1.1 to 1.4 wide. Vasa efferentia pass dorsal to uterine folds and join short vas deferens near cirrus sac. Ovary immediately pretesticular, median, triangular, 0.7 long by 0.8 wide. Ootype and Mehlis' gland to left of ovary. Oviduct joins ovary on the left, passes obliquely to posterior end of Mehlis' gland, then turns sharply forward to join ootype. Laurer's canal not observed. Right vitelline duct extends around anterior margin of ovary then passes between ovary and oviduct to vitelline reservoir; left vitelline duct passes obliquely forward to vitelline reservoir which joins oviduct before entering Mehlis' gland. Ootype lined by flat epithelial cells which appear to be ciliated. Vitelline follicles small, abundant, distributed in U-shaped pattern along ceca dorsal to uterine folds and also filling a wide median area posterior to testes. Uterus composed of many transverse folds which fill space between gonads and ventral sucker; metraterm weakly developed, passes ventral to cirrus sac and ejaculatory duct and opens into genital atrium which is located anterior to genital cone. Genital pore ventral to posterior end of pharynx. Eggs oval, dark brown, operculated, thick-shelled, embryonated, 91 to 94 μ long by 67 to 69 μ wide; shell 7 μ thick. Excretory vesicle Y-shaped, the stem 5 long, arms of vesicle long, sinuous, uneven in thickness, passing around anterior margin of oral sucker where they unite.

Host: Ratfish, *Hydrolagus colliei* (Lay and Bennett, 1839).

Habitat: Coelom.

Type locality: Vicinity of San Juan Island, Washington.

Type specimens: Holotype and serial frontal sections deposited in USNM Helm. Coll. Holotype No. 72266; paratype No. 72267.

Remarks

Otodistomum hydrolagi represents the third species of the genus to be collected from fishes in the region of the San Juan Islands. Lloyd (1938) reported *O. veliporum* (Creplin, 1837) Stafford, 1904, from the stomach of the barndoor skate, *Raja binoculata* Girard, and Kay (1947) described *O. plicatum* from the pyloric stomach of the sixgill shark, *Hexanchus griseus* (Bonnaterre), taken near Friday Harbor, Washington.

The two adults of *O. hydrolagi* were found free in the body cavity of the ratfish, firmly anchored by their suckers to the outer surface of the spiral intestine. There was no indication that they had been encysted. Although they inhabit the body cavity, it would be possible for eggs of the parasite to pass from the coelom through the abdominal pores which are present in the Holocephali.

Dollfus (1937) found the metacercaria of *O. veliporum* encysted in the tissues of *Chimaera monstrosa* L. Ruszkowski (1934) illustrates a metacercaria which he found encysted in the tissues of several specimens of *C. monstrosa*. The anatomy of the digestive tract, excretory vesicle, and the position of the developing gonads closely resembles that of species of *Otodistomum*.

O. hydrolagi is the third species to be reported from the coelom of the host. The other two species are *O. plunketi* Fyfe, 1953, from Lord Plunket's shark, *Scymnodon plunketi* (Waite), and *O. pristiophori* (Johnston, 1902) from the sawfish shark, *Pristiophorus cirratus* Lath. The shape of the body of *O. hydrolagi* is similar to that of *O. plunketi* in being fusiform but the latter is more than twice as long and three times as wide. The testes are distinctly tandem in *O. plunketi* and the transverse band of vitelline follicles is narrow and close to the posterior end of the body. Eggs are larger and the shells thicker in *O. plunketi*.

O. hydrolagi resembles *O. pristiophori* in having opposite testes but differs from that species in shape of body, distribution of vitelline follicles, and in having larger suckers and eggs. In *O. pristiophori* the vitelline follicles are arranged in an H-shaped pattern with a narrow transverse band of follicles passing posterior to the testes. In *O. hydrolagi* the follicles are in a U-shaped design with a broad transverse band of follicles posterior to the testes.

Two specimens of a new species of the genus *Otodistomum* Stafford, 1904, were collected from the coelom of two of 44 ratfish, *Hydrolagus colliei* (Lay and Bennett, 1839), taken by dredge in the vicinity of San Juan Island, Washington. One specimen was prepared as a stained whole mount. The other, a damaged specimen, was used to prepare serial frontal sections. Measurements are in millimeters unless otherwise indicated.

Otodistomum plicatum Kay, 1947
Probably a synonym of Otodistomum veliporum (note thick egg shell)

SPECIFIC DIAGNOSIS

Kay, 1947

Otodistomum plicatum n. sp.

This is an elongated, dorso-ventrally flattened worm which may exceed 100 mm. in length; with a maximum breadth of 8 mm. It is distinguished from other members of the genus by the possession of an exceptionally large cirrus pouch (1.43–2.36 x 0.84–1.57 mm.); an exceptionally small, compressed ovary (0.45–0.7 x 0.29–0.34 mm.); and an egg of unusual size (0.11 x 0.07 mm.) with a very thick shell (0.0075–0.008 mm.).

Locality: Friday Harbor, Washington.

Host: *Hexanchus griseus* (Bonnaterre).

Location in host: Pyloric stomach.

Type specimen: U. S. N. M. Helminthological Collection No. 36908.

DESCRIPTION

The living worm is elongated, ribbon-like, dorso-ventrally flattened; it is creamy white in color with the region just posterior to the ventral sucker darkened by the brown uterine eggs. Fifty-one fixed specimens varied in length from 8 to 83 mm. (average, 47 mm.) and in breadth from 3 to 7. 5 mm. (average, 5.2 mm.). Both large and small worms are, rather constantly, about 1 mm. thick; as much as 1.5 mm. at the level of the egg-filled uterus. The body is covered with folded, smooth cuticle which varies in thickness from 0.03 mm. on a 10 mm. worm to as much as 0.075 mm. on a specimen of 41 mm. As has been reported from other species, the cuticle is much thinned over the suckers; generally not exceeding 0.01 mm. in these areas.

The suckers are large and well-developed, with the oral sucker occasionally partially retracted into a fold of the anterior body. Numerous oblique bands, derived from the longitudinal muscle layer, and occupying the anterior dorsal portion of the body, control its extension and retraction. The ventral sucker extends nearly to the dorsal surface, but may be protruded considerably. The sucker diameter ratio is about 2 : 3; oral sucker from 0.9–1.5 mm., ventral sucker from 1.3–2.4 mm. in diameter.

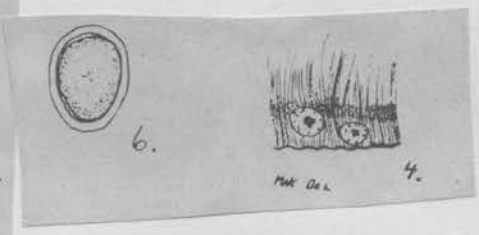
The alimentary canal possesses no unusual features (Fig. 1). It consists of a buccal opening through the anterior sucker giving immediately on a large, muscular pharynx. This communicates with a pouch-like, thin-walled esophagus which branches laterally, and passes slightly anteriorad to either side of the pharyngeal bulb before giving way to the intestinal crura. The pharynx and esophagus are lines with a structureless membrane which is presumably continuous with the cuticle. The intestinal branches are large, more or less folded, and lined anteriorly with flattened or cuboidal epithelium from which protoplasmic processes extend into the lumen (Fig. 4). Posteriorly, particularly in immature worms, the epithelium is of a tall, columnar form, and two types of cells are present (Fig. 5); ill-defined cells bearing protoplasmic processes, and large, club-like cells filled with granules. The two crura extend almost to the posterior end of the body and may be somewhat unequal in length.

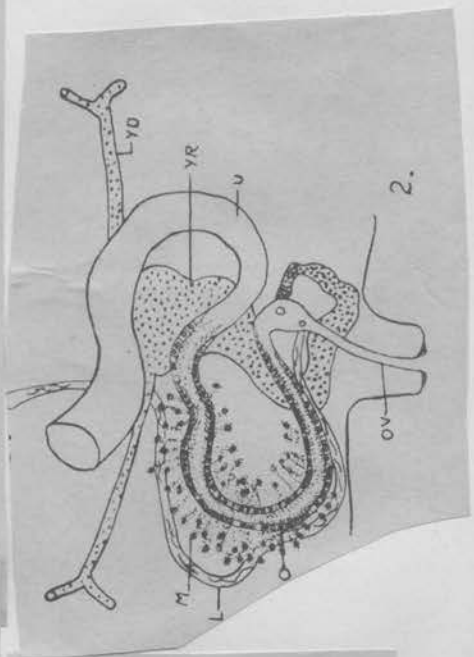
The excretory system resembles that of other members of the genus (Fig. 1). A posterior, terminal, excretory pore opens from a very large vesicle which occupies most of the posterior two-fifths of the body. Anteriorly this bladder is continued by two irregular canals which pass dorsal to the intestinal crura and continue along the lateral margin to the anterior tip of the body. The thin epithelial lining of this entire system is coated with masses of densely staining, globular bodies such as have been reported from a number of trematodes. Flame cells are abundant and widely distributed through the body.

The nervous system has not been studied in detail, but, as far as observed, it conforms to the general pattern of related species.

The organs of the male reproductive system are subject to considerable variation in size. Two testes lie one behind the other just anterior to the middle of the body (Fig. 1). The posterior testis is consistently slightly larger than the anterior (posterior, 23 mm. worm, 1.09 x 0.88 mm., anterior, 0.96 x 0.63 mm.; posterior, 58 mm. worm, 1.43 x 1.39, anterior, 1.35 x 1.31 mm.; posterior, average of ten specimens, 1.17 x 1.05, anterior, 1.08 x 0.99 mm.). From the anterior, median surface of each testicle a thin-walled, convoluted vas deferens, about 0.03 mm. in diameter, passes towards the anterior part of the body. These fuse beneath the anterior border of the ventral sucker, and immediately enter a large cirrus pouch to enlarge into a swollen, comma-shaped, seminal vesicle (Fig. 3). The seminal vesicle is lined by flattened epithelium and surrounded by sparse bundles on longitudinal muscle fibres which are continuous with the outer muscle layer of the ejaculatory duct. This duct arises from the anterior end of the seminal vesicle. It is lined with a low cuboidal epithelium and has both circular and longitudinal muscle layers. After coiling considerably, it emerges from the cirrus pouch near the anterior end, losing its epithelium which is replaced by thin cuticle. The ejaculatory duct terminates within the genital cone where it unites with the uterus before opening through the tip of the cone into the genital atrium. The cirrus pouch is a large, encapsulated, ovoidal structure lying dorsal and anterior to the anterior border of the ventral sucker in the left half of the body. In length it varies from 1.43 mm., in a 23 mm. worm, to 2.36 mm. in a 48 mm. worm; the average is about 1.97 mm. The peripheral portion of the pouch contains many cells similar to those which have been described as prostatic cells; the central portion is largely made up of loose fibres ramifying about the seminal vesicle and its associated ducts. The entire pouch is surrounded by a thin, irregular layer of muscle fibres.

The ovary is small and antero-posteriorly compressed. Size: 0.45 x 0.29 mm. in a 23 mm. worm; 0.7 x 0.34 in a 48 mm. worm; average, 0.61 x 0.30 mm. At most a few dozen developing ova are present at any one time, and a very few primitive oocytes. The organ is invested with a fibrous capsule which, on the anterior surface, is reflected inward to surround the funnel-like beginning of the oviduct (Fig. 7). A peculiar ring of ciliated cells lies on the ovarian side of this





membrane, immediately about the opening of the oviduct (Fig. 8). These possibly aid in directing the mature ovum into the duct.

Initially the oviduct is lined with a flat, pavement epithelium. The posterior portion takes a somewhat tortuous, anterior course and is joined, dorsally, by Laurer's canal and the common yolk duct (Fig. 2). It then enlarges slightly, and its lining changes to cuboidal, apparently ciliated, cells while it is surrounded by a thick layer of Mehlis' glands (Fig. 2, 7). At this point the duct may be considered an ootype. This ootypical portion is thrown into one or two transverse folds before losing its epithelial lining and becoming the membranous, egg-filled uterus.

Laurer's canal passes from its opening in the dorsal body wall to the oviduct along a variable course which typically passes just anterior to the ovary in the mass of loose connective tissue surrounding the ootype and terminates in the portion of the oviduct immediately posterior to the ootype. The common vitelline duct enters the oviduct at approximately the same point. This vitelline duct is the terminal portion of a dorsal yolk reservoir which is partially imbedded in the ootype capsule. The reservoir (Fig. 2) is an irregularly triangular body formed by the fusion of the lateral vitelline ducts which collect material from vitellaria distributed along the surface of the intestinal crura.

Anterior to the ootype the uterus is thrown into a series of transverse folds extending slightly beyond the posterior border of the ventral sucker. The anterior portion of the uterus (Fig. 1) passes dorsad to the right margin of the sucker to emerge ventrad to the median surface of the cirrus pouch in the mid-line of the body where it continues, with few convolutions, to enter the genital cone near its apex. The terminal portion of the uterus forms a strongly muscular metraterm, and well-developed circular and longitudinal muscle layers extend to the point where it fuses with the ejaculatory duct.

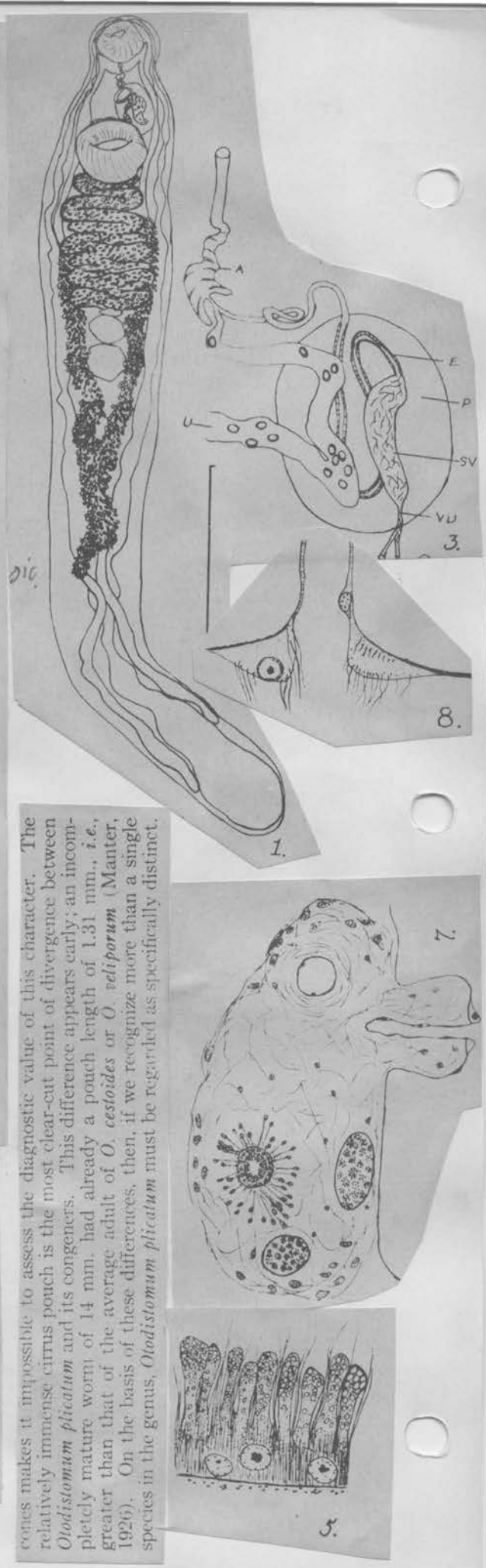
Eggs are very numerous and yellowish to dark brown in color. They are about 0.11 x 0.007 mm. in size and are surrounded by an exceptionally thick shell, 0.0075–0.008 mm. in thickness (Fig. 6). No attempt was made to study the intrauterine development of the egg, but the miracidia are apparently well-differentiated in the terminal part of the uterus.

The common portion of the genital apparatus consists of a cone (0.15 x 0.225 mm. in a moderately expanded specimen) in which the genital ducts unite, a genital atrium, and a genital pore. The atrium (Fig. 3) is an elongated chamber extending antero-ventrad from the genital cone to the genital pore. It may be subdivided into two parts: a posterior, enlarged chamber enclosing the genital cone, and an anterior tube terminating at the pore. The whole structure is lined with cuticle which becomes very thin near the tip of the cone. The musculature is complex; a circular layer extends the length of the atrium and is thickened into heavy rings in the wall of the posterior chamber; a number of longitudinal bundles are present, forming an incomplete layer; and fibres from the longitudinal muscles of the body wall extend obliquely to the wall of the anterior tube. These probably function together in the eversion and retraction of the cone. The total length of the atrium approximates a millimeter about equally divided between the two sections; the maximum diameter of the posterior portion is about 0.3 mm. while the anterior portion is half as broad. While the spatial relationships of the parts vary the structural details seem rather constant. Unfortunately no worms were available with the cone everted so that it was impossible to determine what changes in relationship this action would produce. The genital pore lies ventral to the esophagus and just posterior to the pharynx. About its margin the cuticle is thrown into folds which often take the form of small, inwardly directed papillae.

DISCUSSION

The characters by which species of *Otodistomum* are distinguished are far from satisfactory. Between the reported species there is very considerable overlapping of characters. Yet Manter's careful and detailed study (1926) left him unwilling to disturb the existing taxonomy although, after critical comparison of *Otodistomum cestoides* and *O. veliporum* he ends by finding that, "The most certain distinction is egg size." *O. pristophorus* (Johnston, 1903) is distinguished by its peculiar, coelomic habitat; but, morphologically, Odhner (1911) considered it identical with *O. veliporum*. The confirmation of its coelomic occurrence (Woolcock, 1934) suggests that it is probably specifically distinct.

In comparing *Otodistomum plicatum* with *O. veliporum* collected in the same area, and with published descriptions of *O. veliporum* and *O. cestoides* the condition observed by Manter is evident; the worm is visibly different, but clear-cut, diagnostic characters are few. As he found, the egg size seems to be the most constant character, and this size is considerably above any previously reported in the genus. The ovary is regularly compressed and is smaller than that of comparable specimens of *O. veliporum* which I have examined or of *O. veliporum* and *O. cestoides* as given by Manter. However, the latter's work makes it doubtful that either size or position of gonads can be considered as distinguishing factors in this genus. The genital atrium appears distinctive, but the absence of specimens with everted cones makes it impossible to assess the diagnostic value of this character. The relatively immense cirrus pouch is the most clear-cut point of divergence between *Otodistomum plicatum* and its congeners. This difference appears early; an incompletely mature worm of 14 mm. had already a pouch length of 1.31 mm., *i.e.*, greater than that of the average adult of *O. cestoides* or *O. veliporum* (Manter, 1926). On the basis of these differences, then, if we recognize more than a single species in the genus, *Otodistomum plicatum* must be regarded as specifically distinct.



Otodistomum plunketi Fyfe, 1953

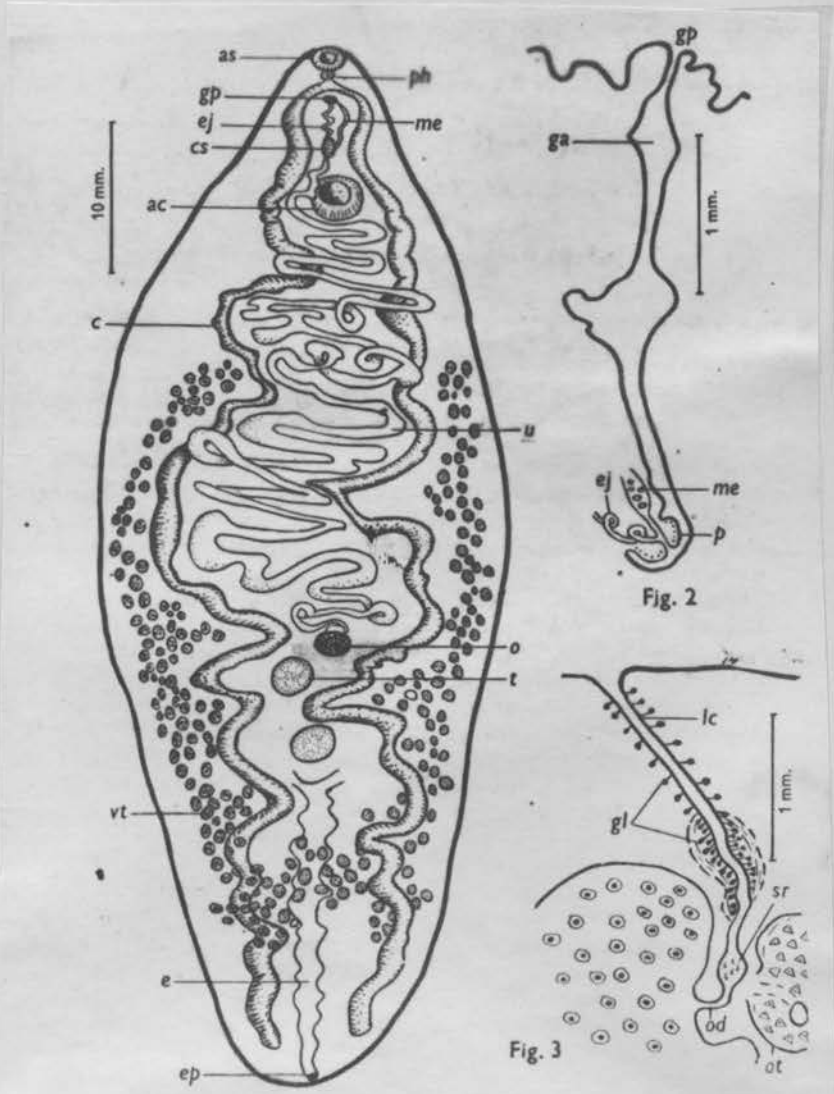


Fig. 1

Fig. 2

Fig. 3

Fig. 1 was drawn by projection from a stained mounted specimen, Figs. 2 and 3 with the ai
a lucida. Fig. 1. *Otodistomum plunketi*. Dorsal view of adult seen by transparency. Scale = 1(
. Sagittal section through genital pore and atrium showing normal condition of genital p
1 mm. Fig. 3. Transverse section through body showing Laurer's canal and oviduct en
al receptacle. Scale = 1 mm. *as*, anterior sucker; *ac*, acetabulum; *c*, caecum; *cs*, cirrus sac; *e*, exc
ep, excretory pore; *ej*, ejaculatory duct; *ga*, genital atrium; *gl*, glands; *gp*, genital pore; *lc*, La
me, metraterm; *o*, ovary; *od*, oviduct; *ot*, ootype; *p*, genital papilla; *ph*, pharynx; *sr*, sc
acle; *t*, testis; *u*, uterus; *vt*, vitellaria.

DESCRIPTION (Fig. 1)

Body thick, broad and tapering to both ends (breadth not less than one-third of length). Large muscular parasites of this type can show a great range in body size and proportions depending on the degree of contraction. A series of sizes is given both for living and preserved specimens. Average size of living specimen, 65 by 33 mm.; of slightly flattened and preserved, 60–82 mm. by 33–27 mm.; of preserved without flattening, 46–62 mm. by 27–32 mm. Colour milky white with dark patches showing the position of eggs in uterus and of vitelline gland. Cuticle non-spinous, thick and wrinkled. Oral sucker 3·00–3·90 mm. in diameter; acetabulum 4·00–5·19 mm. in diameter; suckers ratio 1 : 1·5.

Pre-pharynx absent; pharynx conspicuous; oesophagus very short; caeca very long and undulating, reaching almost to the posterior end.

Genital pore median, nearer oral sucker than acetabulum, pore on raised papilla with thickened cuticle. Genital atrium narrow and deep (Fig. 2), size 2·5–3·3 mm. by 0·405–0·71 mm.; circular muscles surround atrium, longitudinal muscles connect with muscles of body wall, sphincter round entrance of atrium. Lining of atrium glandular and non-cuticular, except for outer edge where very thin cuticle extends in from surface of body. All specimens examined had ripe eggs in atrium, many of the eggs being imbedded in the glandular lining while indentations indicated the position where eggs had been.

Genital papilla at base of atrium, very small, non-muscular, non-cuticular, size 0·36–1·00 mm. by 0·19–0·33 mm. Of nine specimens sectioned none showed papilla everted. According to Manter (1926, p. 23) egg-laying occurs while the papilla is completely reduced, and in all these specimens egg-laying was proceeding. Extrusion of papilla is probably brought about by contraction of body wall.

Cirrus sac between genital pore and acetabulum, large, ovoid, slightly muscular, size 1·60–1·35 mm., contains seminal vesicle and prostate gland; seminal vesicle wide, curved, tubular; prostatic duct leaves anterior end of seminal vesicle and turns back and then forwards receiving ducts of prostatic gland; narrow muscular ejaculatory duct connects prostatic duct with genital atrium.

Testes two, posterior to mid-body, rounded to elongate, tandem, average size of anterior testis 2·50 by 3·00 mm. Ovary in front and to the right of testes, average size 1·88 by 2·63 mm., flattened anteriorly and curved posteriorly. Testes and ovary not touching. Ootype anterior to ovary. Laurer's canal (Fig. 3) well developed, straight, leading slightly posteriorly, non-cuticular; longitudinal muscles and glands surround canal which becomes slightly convoluted and more glandular as it nears the ootype, the whole being surrounded by a muscular sheath; canal enters seminal receptacle at junction of oviduct and duct to uterus. Vitelline follicles in posterior two-thirds of body extending almost to posterior end. Uterus anterior to ovary; metraterm glandular and cuticular, joins ejaculatory duct as it enters genital papilla. Eggs thin-shelled, oval, average size (50 measurements) 0·111 by 0·075 mm., thickness of shell 0·009 mm. Excretory vesicle a long wide tube extending forward to level of posterior testis.

-OVER-

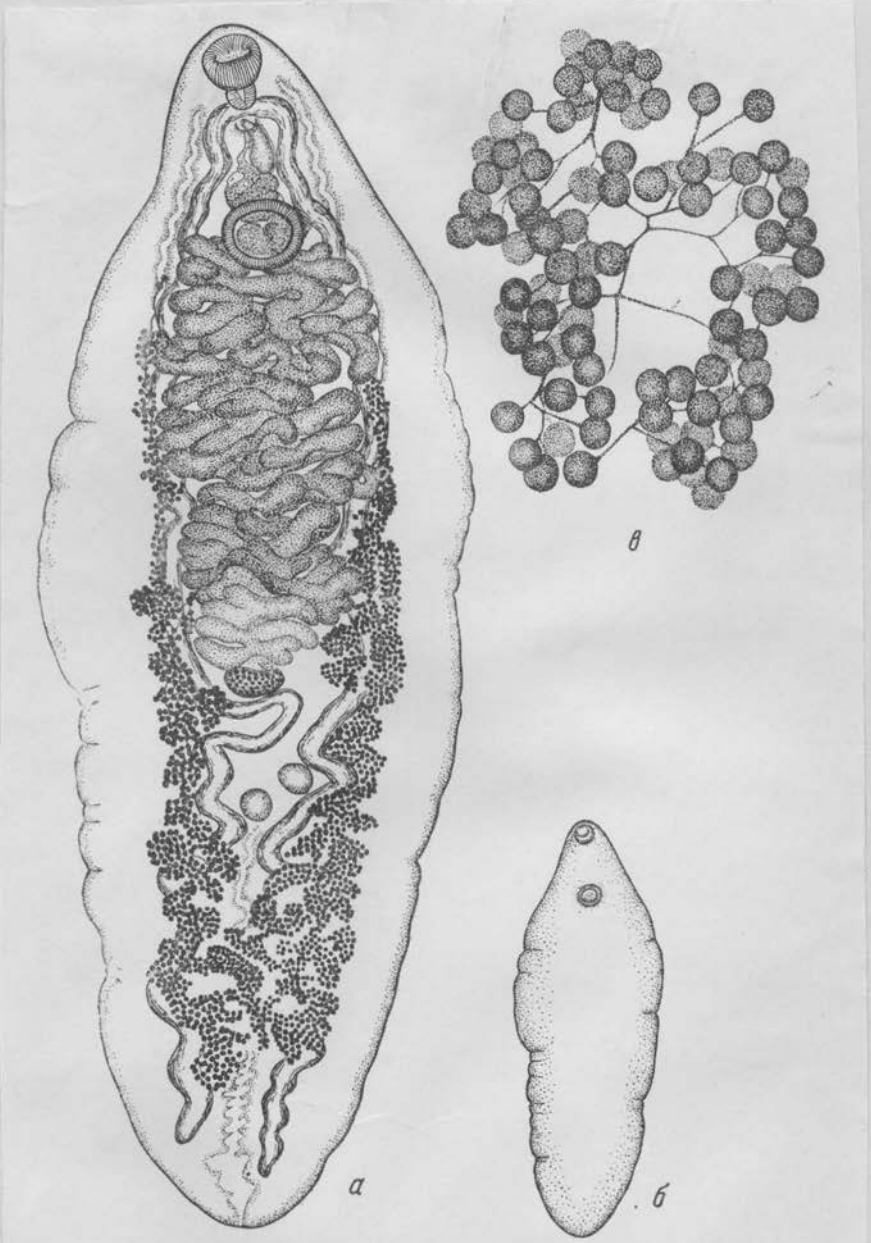
Otodistomum plunketi Fyfe, 1953

(Рис. 203—204)

Хозяева: рыбы—*Scymnodon plunketi* (по Файфу); *Raja longirostris* (по К. И. Скрябину).

Локализация: полость тела.

Места обнаружения: Новая Зеландия, СССР.



204. *Otodistomum plunketi* Fyfe, 1953 (по Скрябину)

а — марита (увелич. около 3 раз); *б* — внешний вид мариты в натуральную величину; *в* — участок желточников

FROM SKRJABIN, VOL. 14

DISTOMUM PRISTIOPHORI, ~~sp.n.~~ JOHNSTON, 1902

Body elongated, pointed at the anterior end, and rounded at the posterior, flattened dorsoventrally, with rounded sides; head-lobe triangular. Average length 25 mm., breadth 6 mm.

Oral sucker deep, cup-shaped and small; subterminal, the opening being on the ventral aspect; diameter 1·5 mm. Ventral sucker orbicular, sessile, with deep cavity, larger than oral sucker; diameter 2·5 mm. Both suckers very muscular, devoid of hooks or lobes of any kind.

Common genital aperture situated near the middle line about half-way between the oral and ventral suckers. Excretory aperture situated at the extreme posterior end. Laurer's canal opening on the dorsal surface about the middle of the body.

Cuticle with a transversely striated appearance owing to fine closely arranged grooves running round the worm.

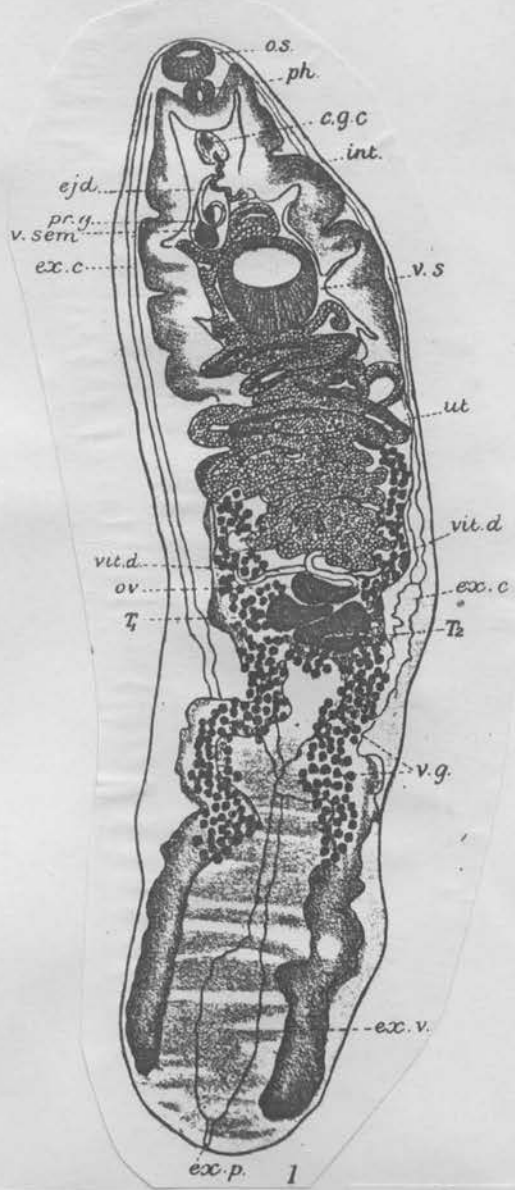
Alimentary canal simple; mouth situated at the base of the oral sucker, leading into a well developed, muscular pharynx; behind the pharynx the canal immediately divides into the two limbs of the intestine, the œsophagus being practically non-existent. Limbs of the intestine unbranched, but not quite simple, being thrown into bays and folds throughout their length; they terminate in blind sac-like ends at the posterior end of the body. Walls of the intestine thick, lined by long columnar cells, nucleated at the base, of a glandular character.

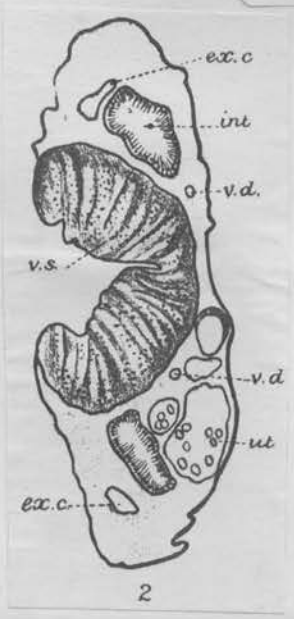
Excretory system very well developed, consisting of two main canals which run forwards and unite in front of the oral sucker. In the anterior half of the body these excretory vessels run laterally; but some distance behind the testes they bend inwards and meet about the middle line to form a single median vessel, which opens into a large excretory vesicle in the posterior end of the body. A number of constrictions occur along the excretory canals. The excretory vesicle opens on the exterior through a very short canal, ending in the excretory pore. The excretory canals were partly filled up with crystals belonging to the cubical system, and which had become stained by eosin; some envelope crystals of calcium oxalate were present.

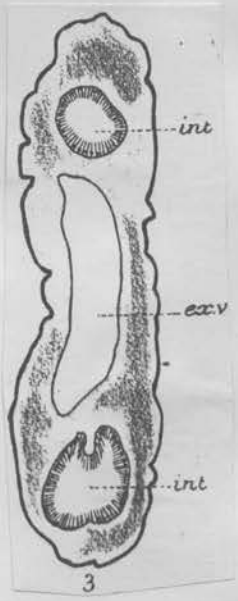
Testes two, situated just posterior to the middle of the body, ovoid in shape; lying almost on the same level. The undeveloped sperms give their interior that follicular appearance usual in Trematodes, but there is also a large number of fully developed sperms present. Each vas deferens, passing dorsal to the uterus and ventral sucker, joins its fellow at the origin of the vesicula seminalis, which is large and pear-shaped, and filled with fully developed spermatozoa with small round heads and long tails. The vesicula seminalis is continued as the ejaculatory duct which traverses the penis to open on the exterior. The vesicula seminalis and the proximal part of the ejaculatory duct are surrounded by a strong muscular sac; the somewhat considerable space between the walls of the vesicula seminalis and this sac are traversed by muscular and connective tissue fibres which join the walls of each. Between the fibres lie a number of glandular cells representing a prostate gland.

The male and female ducts open close together into the common genital chamber, which is of some size, and which opens on the exterior on the ventral surface on the middle line and half-way between the two suckers.

The ovary is an ovoid body of solid appearance lying just anterior to the testes. In the walls of the distal part of the oviduct the shell glands are situated, and this part of the oviduct constitutes the ootype. Into the end nearest the ovary Laurer's canal opens; about its middle the main duct of the vitelline glands.







Distomum pristiophori.

Fig. 1.—View of the whole animal (×6).
Fig. 2.—Transverse section through the middle of the ventral sucker (×15)
Fig. 3.—Transverse section through posterior end showing the large excretory vesicle (×20).

—OVER—

The uterus is a very long and narrow tube which is thrown into a considerable number of folds between the ovary and ventral sucker; skirting the side of the ventral sucker it runs forwards to open alongside the male opening into the common genital chamber. There is no vagina. The uterus is full of eggs, which are characterised by a very thick chitinous shell. The average longitudinal diameter of the eggs is 0·077 mm., transverse 0·062 mm.; the thickness of the shell is 0·008 mm. The eggs consist of the ovum and three or four large vitelline cells.

The vitelline glands are a number of small, rounded, grape-like follicles which communicate with one another by small ducts. A main lateral duct on each side, about the level of the ovary, opens into a median duct; these median ducts meet together and open into the ootype by a single opening. The follicles are situated laterally, in the middle third of the body, and are grouped round the intestine on each side of the body. The vitelline mass consists of large nucleated cells of an albuminous character.

Laurer's canal, a canal with muscular walls, opens on the exterior about the middle of the dorsal surface, opposite the middle of the ovary. It skirts round the right side of the ovary and opens into the proximal end of the ootype. In its interior a number of sperms can be seen. The canal is quite large enough to be used in copulation.

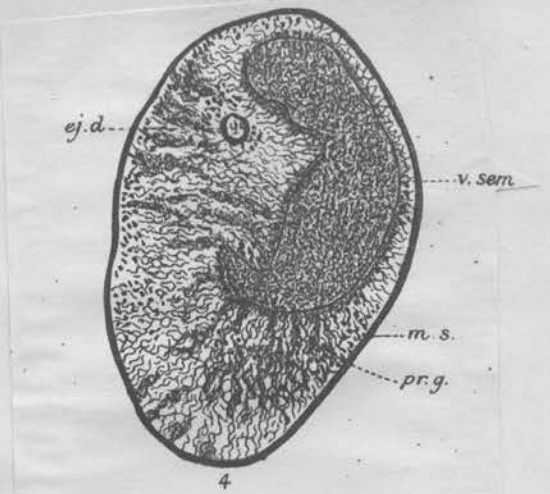
The most characteristic features of the worm are its size, the character and position of the suckers, the folded but unbranched intestine, the ovoid shape of the ovary and testes and their situation, the great length of the uterus, the grape-like vitelline glands, and the well developed excretory system.

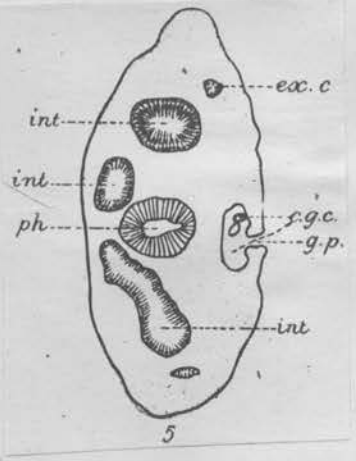
The simple nature of the intestine, the absence of hooks or lobes from the suckers, the almost total obliteration of the œsophagus, and the absence of a retractile telescopic tail part indicate the position of this species to be in Dujardin's subgenus *Brachylaimus*.

In external characters, as general shape, size, character and position of the suckers and transversely striated appearance, it closely resembles *D. veliporium*, Creplin, found in the American barn-door skate, *Raja lævis*, in *Prionodon milberti*, and in *Hexarchus griseus*. In its internal anatomy it shows a fairly close resemblance to *D. tereticolle*, Rud. The excretory system is very marked and very similar in each. The limbs of the intestine in *D. tereticolle* are without the folds shown in *D. pristiophori*. They both have the uterus long, slender and much folded, and a similar structure, arrangement and amount of development in the vitelline glands; in this new species the ovary and testes are situated much nearer together.

The figures for the plate were drawn by my wife.

I am indebted to Professor Haswell for three specimens of this Trematode, which were found in the body cavity of the Sawfish Shark, *Pristiophorus cirratus*, Lath., at Sydney. I have examined several specimens of the same host since receiving those from Professor Haswell, but have found no Distomes, though in the body cavity of one specimen a number of eggs were found which very probably belong to the same species, for the eggs with their very thick shells are characteristic of the species; the worms may have escaped through the abdominal pores when the fish was caught. This worm has a very extensible neck; fastening itself by the ventral sucker it stretches its neck out for more than an inch, longer than the body itself.





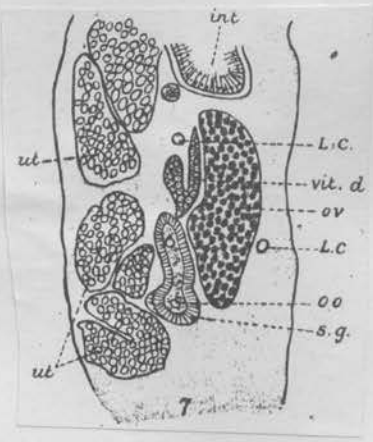


Fig. 4.—Transverse section through the vesicula seminalis and its surrounding sac (× 50).

Fig. 5.—Transverse section through the anterior end showing common genital opening and chamber (× 15).

Fig. 6.—Portion of the worm showing termination of genital ducts (× 20).

Fig. 7.—Transverse section through the ovary showing Laurer's canal, ootype and vitelline duct (× 20).

All, except fig. 1, drawn with the camera lucida.

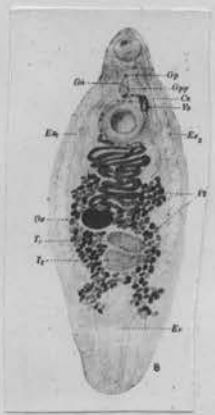
Otodistomum pristiophori (Johnston,S.J.)

Synonym: Distomum pristiophori Johnston,1902 ~~or 1903~~

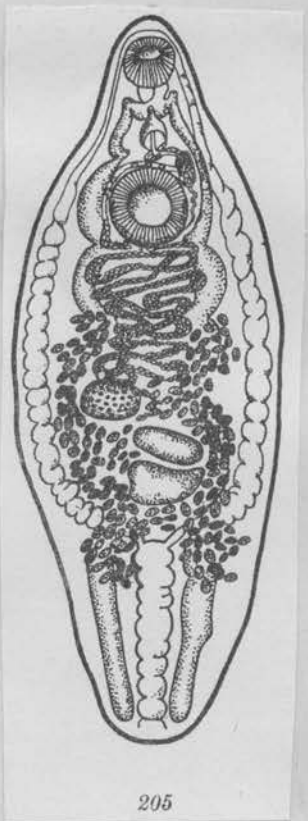
Woolcock (1935) considers this species as distinct from O.veliporum with which Odhner thought it very similar or identical. Woolcock confirms the occurrence of the worm in the coelom and not the stomach of the host, Pristiophorus cirratus (Lath.), the sawfish.

The genital papilla almost fills the genital atrium. Woolcock gives the following table comparing her form with the original description.

	Sydney specimen	Port Philip spec.
Length.	25 mm.	14 mm.
Breadth	6	5.5
Oral sucker	1.5	1.
Ventral sucker	2.5	1.54
Egg length	77μ	66-72μ
Eggs width	62 μ	48-51 μ
Thickness of shell	8 μ	7.5 μ



FROM WOOLCOCK, 1935



205

205. *Otodistomum pristiophori* (Johnston, 1902) (по Вулкок, 1935)

Otodistomum sp. Manter, 1934

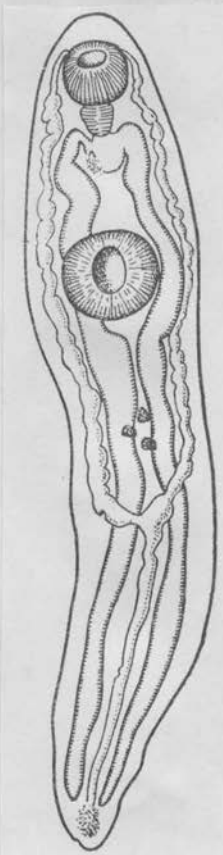
(Рис. 206)

Хозяин: рыба *Coelorhynchus carminatus* (Goode).
Локализация: желудок, возможно кишечник.
Место обнаружения: Флорида.

Все пять экземпляров были неполовозрелые. Форма тела, кишечный тракт, экскреторная система, рудиментарная половая бурса и гонады соответствуют видам рода *Otodistomum*

Литература: Manter, 1934.

FROM SKRJABIN, VOL. 14



206

206. *Otodistomum* sp. Manter, 1934 (по Мантеру, 1934)

Proterometrinae ~~n. subfam.~~ YAMAGUTI, 1958

Subfamily diagnosis. — Azygiidae: Body plump. Oral sucker very large, acetabulum small, postequatorial. Ceca terminating at posterior extremity. Testes diagonal, or rather juxtaposed, close to posterior extremity. Cirrus pouch rounded, preacetabular. Ovary median, between and anterior to testes. Vitellaria extending in lateral field from level of pharynx or oral sucker to ovariotesticular zone. Uterus between ovary and acetabulum, intruding into forebody. Excretory vesicle Y-shaped, arms united anteriorly.

Proterometra Horsfall, 1933

Generic diagnosis. — Azygiidae, Proterometrinae: Body plump, rather elliptical. Oral sucker subterminal, very large; pharynx small. Esophagus very small, ceca terminating at posterior extremity. Acetabulum smaller than oral sucker, postequatorial. Testes diagonal or rather symmetrical, close to posterior extremity. Cirrus pouch rounded, preacetabular, containing winding seminal vesicle and prostatic complex. Genital pore pre-acetabular. Ovary median, between and in front of testes. Uterus forming a loop between ovary and acetabulum and then another between two suckers. Vitellaria extending in lateral fields from level of pharynx or oral sucker to ovariotesticular zone. Excretory vesicle Y-shaped, arms united anteriorly over oral sucker. Parasitic in intestine of freshwater fishes.

Genotype: *P. macrostoma* Horsfall, 1933 (Pl. 15, Fig. 191),? syn. *Cercaria melanophora* Smith, 1932; *Cercaria fusca* Pratt, 1919.

Cysticercous cercaria swimming freely while enclosed in tail vesicle, with distinct genital anlagen, develops in *Goniobasis livescens* and *Pleurocera acuta;* fed experimentally to *Allotis humilis* which yielded *macrostoma*-like distomes. — Horsfall (1934). Dickerman (1934) found also a similar cercaria in *Goniobasis livescens correcta* and fed it to *Helioperca incisor* with positive results. Dickerman (1945) divided *Cercaria macrostoma* from *Goniobasis* and *Pleurocera* into Type I, II and III. Miracidia — Hussey (1945).

Other species:

P. catenaria Smith, 1935, in *Apomotis cyanellus;* Florida. *Cercaria catenaria*, cystocercous, develops into *P. catenaria*.

P. hodgesiana Smith 1936. Cercaria from *Goniobasis* sp. developed experimentally in *Apomotis cyanellus;* Alabama.

P. sagittaria Dickerman, 1946. Cercaria develops in *Goniobasis* and *Pleurocera*, adult in centrarchid fishes — Dickerman (1946). Also in turtles — Dickerman (1937).

PROTEROMETRA Horsfall, 1933

Small distomes which do not exceed 3 mm. in length when elongated in the living condition. Suckers powerfully developed, the oral sucker being twice the size of the acetabulum. Lateral branches of the excretory system unite anterior to the oral sucker. Genital organs behind middle of body; ovary median and anterior to the lateral testes; genital pore near the acetabulum. Vitellaria acinous, infracecal, extending along sides of body from the level of the pharynx to the level of the testes.

Type species: P.macrostoma Horsfall, 1933

Above diagnosis from Dickerman, 1934

Proterometra macrostoma (Faust, 1918) Horsfall, 1933

(Рис. 207)

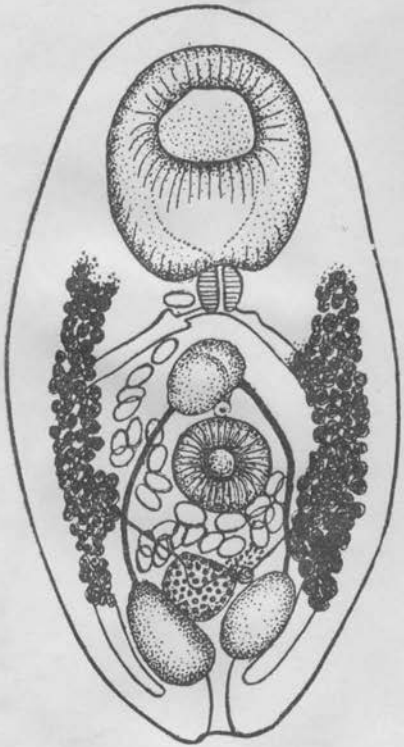
Синонимы: *Cercaria macrostoma* Faust, 1918; *Cercaria melanophora* Smith, 1932

Хозяева: рыбы — *Pomoxis annularis*, *P. sparoides*, *Amblophites rupestris*, *Chaenobryttus gulosus*, *Lepomis cyanellus*, *L. humilis*, *L. pallidus*, *Micropterus salmoides*, *M. dolomicu*.

Локализация: жабры, пищевод, желудок.

Место обнаружения: США.

FROM SKRJABIN, VOL. 14



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207. *Proterometra macrostoma* (Faust, 1918) (из Ямагути, 1953)

Proterometra albacauda Anderson & Anderson, 1967

***Proterometra albacauda* sp. n.**
(Figs. 1–4)

Adults (Fig. 1)

Living specimens yellow to tan; elliptical when extended, contracting to oval; oral sucker subterminal, opening anteroventrally; acetabulum approximately two-thirds of body length from anterior end; ratio of acetabulum to oral sucker diameters usually 1:2, range 1:1.9 to 1:2.1. Fixed specimens oval; testes oblique, at posterior end of body, piriform to elliptical, one regularly larger than other; ovary anterior to one testis, oval; vitellaria lateral, extending from about posterior margin of oral sucker to approximately level of posterior fourth testes; uterus intercecal, most anterior portion a single loop between oral sucker and genital atrium, usually nearer atrium than sucker; size of eggs increasing slightly from ootype to genital atrium; miracidia, not fully developed, in eggs nearest atrium; genital papilla not projecting over anterior margin of acetabulum.

Cercariae (Fig. 2)

Furcocystocercous; tail stem and furcae pure white; tail stem slightly tapered toward anterior end, not sharply divided into regions except that posterior third nonpapillose; papillae on anterior two-thirds in four lateral rows of eight to ten each, bearing three to five radially arranged spines (Fig. 3); furcae held at approximately right angles to tail stem during undulatory swimming motion, moving gently between 45° and 0° during drifting; final movement active swimming in irregularly upward path to surface, then drifting downward until upward motion stimulated by contact with any solid object. Distome encysted in cavity at anterior tip of tail, differing from adult only in size and in number of eggs *in utero* (0–10); no apparent embryonic development in eggs.

Germinal sacs (Fig. 4)

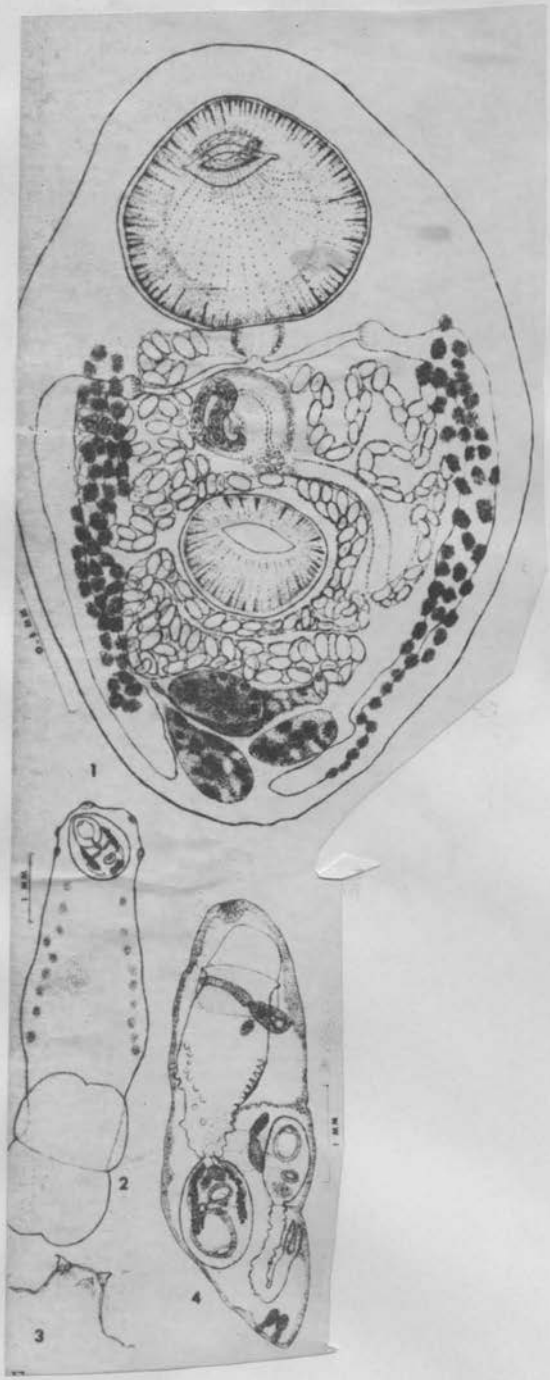
Two generations, distinguishable only by content; maximum size 6.1 by 1.5, cylindrical, one end slightly flattened with thickened wall, minute pore in thickened portion; no sucker or pharynx; body wall very delicate, nonpigmented.

Hosts: Adults in *Lepomis gibbosus* L. (experimental). Larvae in *Goniobasis catenaria* Say.

Locality: Blue Springs, Marianna, Jackson County, Florida.

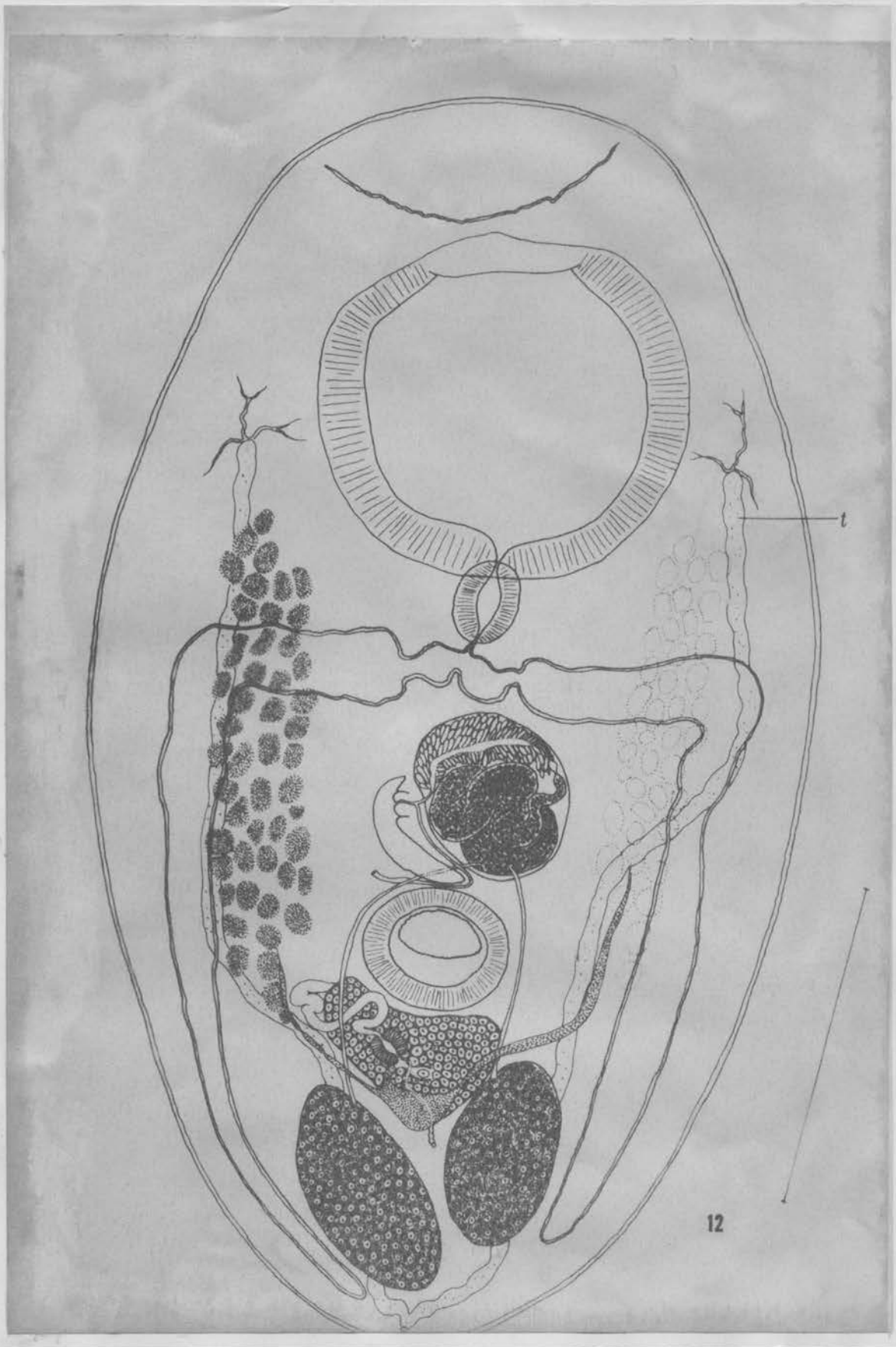
Habitat: Adults in cardiac stomach of fish. Larvae in gonoducts of snail.

Specimens deposited: USNM Helm Coll. No. 61229 (adult, holotype) and 61230 (cercaria, paratype).



Proterometra catenaria Smith, 1934

Young adult ; from master's thesis Paul Lewis, 1961
Final hosts: Lepomis marginatus, Chaenobryttus gulosus; Centrarchus macropterus
Snail host: Goniobasis curvicostata



Proterometra catenaria Smith, 1934

Proterometra catenaria Smith, 1934
(Figs. 8–10)

Smith's (1934) brief description of *P. catenaria* does not include reference to any of the characters used in the foregoing descriptions, and requires some emendation. It seems advisable to include a redescription here.

Adults (Fig. 8)

Living specimens pale yellow; elliptical when extended, contracting to oval; oral sucker subterminal, opening anteriad; acetabulum approximately four-fifths of body length from anterior end; ratio of acetabulum to oral sucker diameters 1:2.5 to 1:2.8. Fixed specimens oval; testes near posterior end of body, oval or piriform, long axes nearly 90° to each other, one consistently larger than the other; ovary nearly median, piriform, axis nearly transverse; ootype posterolateral to ovary (anterolateral in few specimens); vitellaria lateral, anterior extent varying between level of anterior third to posterior third of oral sucker, posterior extent to level of posterior margin of acetabulum; uterus with outermost loops lateral to margins of intestinal ceca, anterior ends of loops extend to same levels as vitellaria; very slight increase in size of eggs during passage through uterus; embryos in eggs nearest atrium not in miracidial form; genital atrium at anterior margin of acetabulum.

Cercariae (Fig. 9)

Furcocystocercous; tail stem and furcae white or cream color, with numerous very small particles of uniformly distributed pigment; furcae often more yellowish than tail stem, long, tapering, characteristically held at right angles to tail stem, not curled; anterior end of tail stem rounded, base of rounded area with circlet of eight to 10 slightly elevated areas (not sufficiently protruding to be designated as papillae) each armed with 12 to 20 spines; next third of tail without papillae or spines, followed by a band of about one-fourth tail stem with 20 to 30 papillae arranged more or less in a spiral encircling the stem 5 or 6 times, each papilla (Fig. 10) bearing 10 to 20 spines; remainder of tail aspinous, although furcae have numerous small papillae; movement mostly on substrate, described by Smith (1934) as ". . . a peculiar, eel-like, sinuous, undulating movement." Swimming toward surface infrequent, slow and graceful in comparison with other species. Distome in cavity anterior to and overlapping zone of armed papillae, essentially adult except for size and number of eggs in utero.

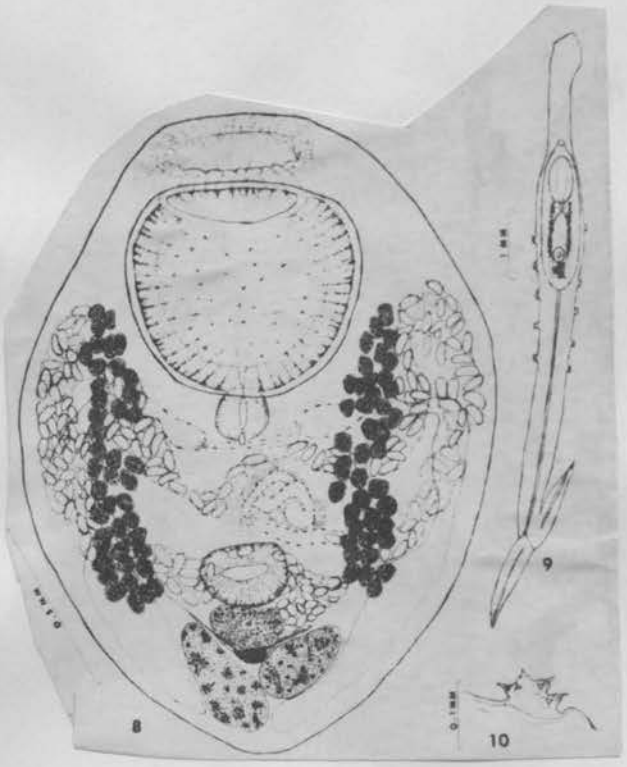
Germinal sacs

No distinguishing differences from other species of cercariae in second generation of sacs.

Hosts: Adults in *Lepomis cyanellus* Rafinesque and (experimentally) in *L. gibbosus* L. Also reported from other centrarchid fishes (Smith, 1934). Larvae in *Goniobasis catenaria* Say.

Locality: Material of this study from Blue Springs, Marianna, Jackson County, Florida. Also found widely distributed in northern and central Florida.

Habitat: Adults in esophagus of fish. Larvae in gonoducts of snail.



Proterometra catenaria Smith,1935

from Buttner,1950

3. *CERCARIA CATENARIA* S. Smith 1935

Une nouvelle espèce de cystocercaire progénétique a été découver
par S. Smith, en 1935. Les mollusques parasités appartenaien

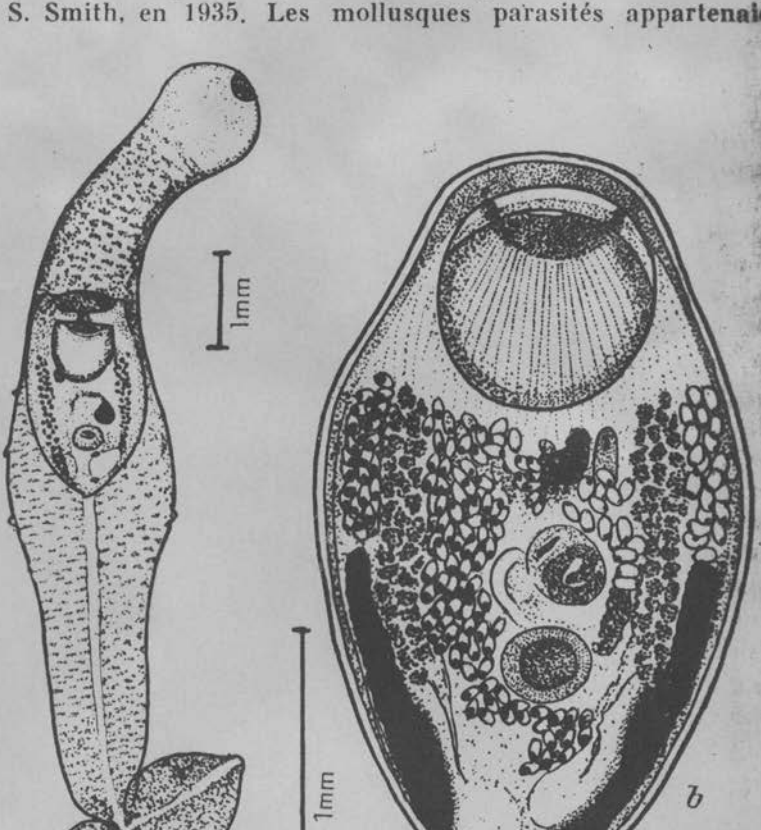
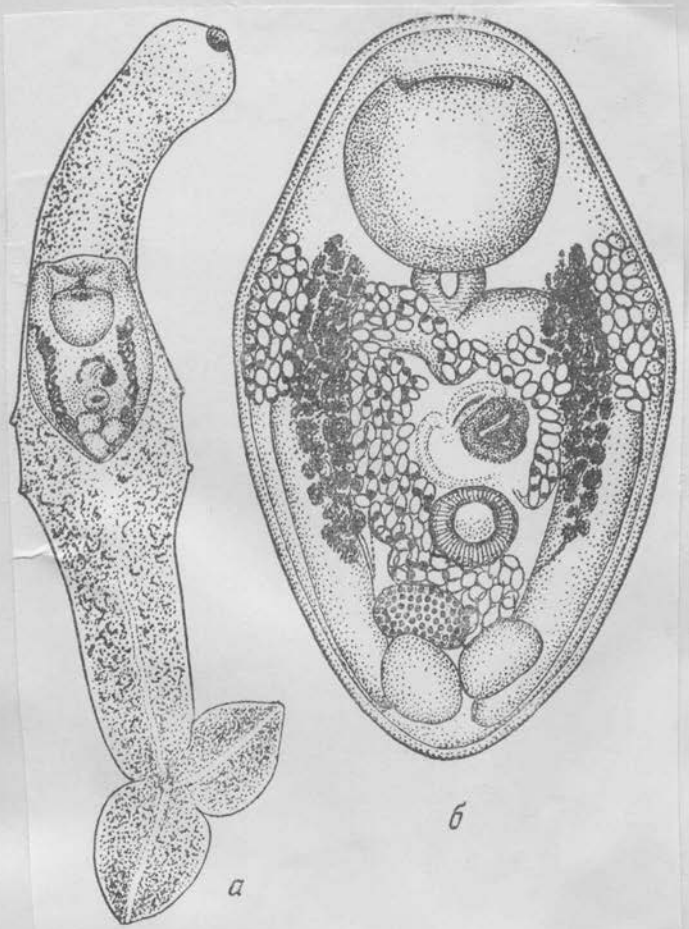


Fig. 25. — *a*, *Cercaria catenaria* Smith, 1935 ;
b, *Proterometra catenaria* Smith, 1935 (d'après S. Smith, 1935)

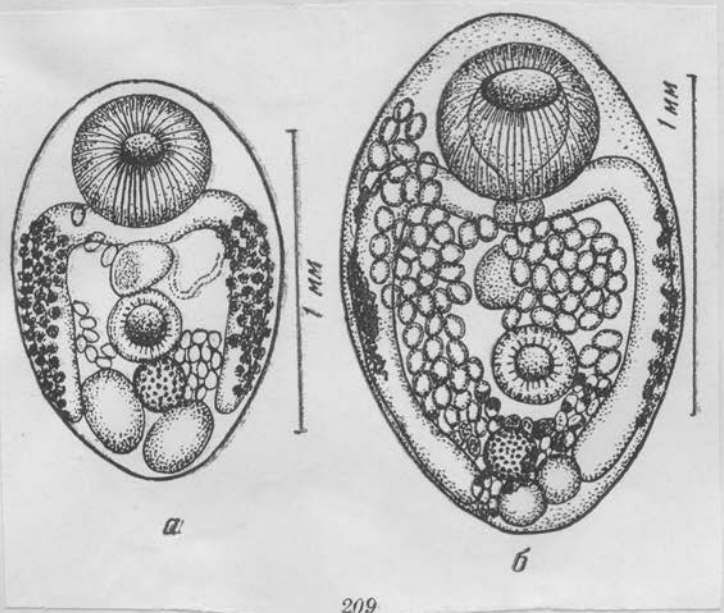
d'une part, à l'espèce *Goniobasis catenaria* Say, trouvée en Floride septentrionale et centrale, dans les trois systèmes de « River drainage », appelés the Apalachicola, the St-Johns et the Suwannec ; d'autre part, à l'espèce *Goniobasis doolyensis* Lea, récoltée dans le



208

208. *Proterometra catenaria* Smith, 1935 (по Смит, 1935)

а — *Cercaria catenaria* от *Goniobasis catenaria*; *б* — марита от *Apomotis cyanellus*



209

209. *Proterometra hodgesiana* (Smith, 1932) (по Смит, 1936)

а — *Cercaria hodgesiana*, вышедшая из цисты; *б* — марита из *Apomotys cyanellus*

FROM SKRJABIN, VOL. XIV.

FAMILY AZYGIIDAE

Proterometra dickermani ~~n. sp.~~ ANDERSON, 1962

The author is indebted to Florence Mendenhall Anderson for the preparation of the figures.

Figures 1–9

All measurements in the following descriptions are in millimeters.

ADULTS. (Fig. 1.) Living specimens contract to oval shape, 1.61 x 0.91; extend to somewhat pyriform, 2.6 x 1.0; tan with slight pinkish tinge; fixed specimens oval, 1.76–1.87 x 1.01–1.18; oral sucker subterminal, 0.52 x 0.50; acetabulum posterior to mid-body, 0.31 x 0.26; pharynx 0.08 diameter, 0.11 long; unbranched portion of esophagus 0.01 long, branches 0.16; testes elliptical, 0.33 x 0.12; ovary oval, 0.19 x 0.12; vitellaria lateral, extending from mid-level of oral sucker to or beyond posterior margin of testes; uterus intercaecal, coils extend anterior to posterior margin of oral sucker; ova increase from 0.074 x 0.047 to 0.098 x 0.066 during passage from oötype to genital atrium; fully-developed active miracidia in ova nearest atrium; genital pore opens through conical papilla 0.20 in diameter at base, projecting over the anterior margin of the acetabulum.

CERCARIAE. (Figs. 4–7.) Body portion of full-grown cercariae identical with adult, but attached to tail by cuticular and muscle fibers extending into tail cavity and merging with the dorsal wall of the cavity; heavily pigmented, brownish-yellow; tail fully extended 3.15 long, 0.28 greatest width, in three distinct regions: anterior portion cylindrical, 1.4 x 0.28, bearing numerous aspinous mammillations; posterior stem flattened, 1.05 x 0.28 x 0.14, not mammillated; paired flappers 0.7 long, 0.28 wide; anterior portion with central cavity which often contains ova; as many as 293 ova counted in cercarial uterus, of which 84 contain active miracidia.

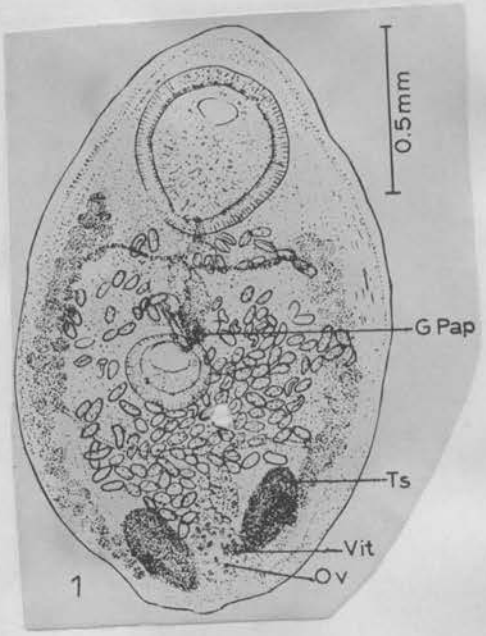
GERMINAL SACS. (Fig. 2, 3). Two generations distinguishable only by content, developing secondary sacs in the primary, cercariae in the secondary; maximum size 5.94 x 0.98; cylindrical, one end rounded, the other flattened; wall thick at flat end, not modified as sucker or pharynx but with minute pore into cavity of sac; small sacs colorless, becoming increasingly brownish-yellow with growth; four to ten embryos, graded in size and degree of development, in each.

Hosts: Adults in *Lepomis gibbosus* and *L. macrochirus* (experimental only). Larvae in *Goniobasis livescens.*

Locality: Oqueoc river, Presque Isle County, Michigan.

Habitat: Adults in esophagus of fish.
Larvae in coelom of rectal area of snail.

Type specimens: U. S. National Museum Helminthological Collection Nos. 39091, 39092.



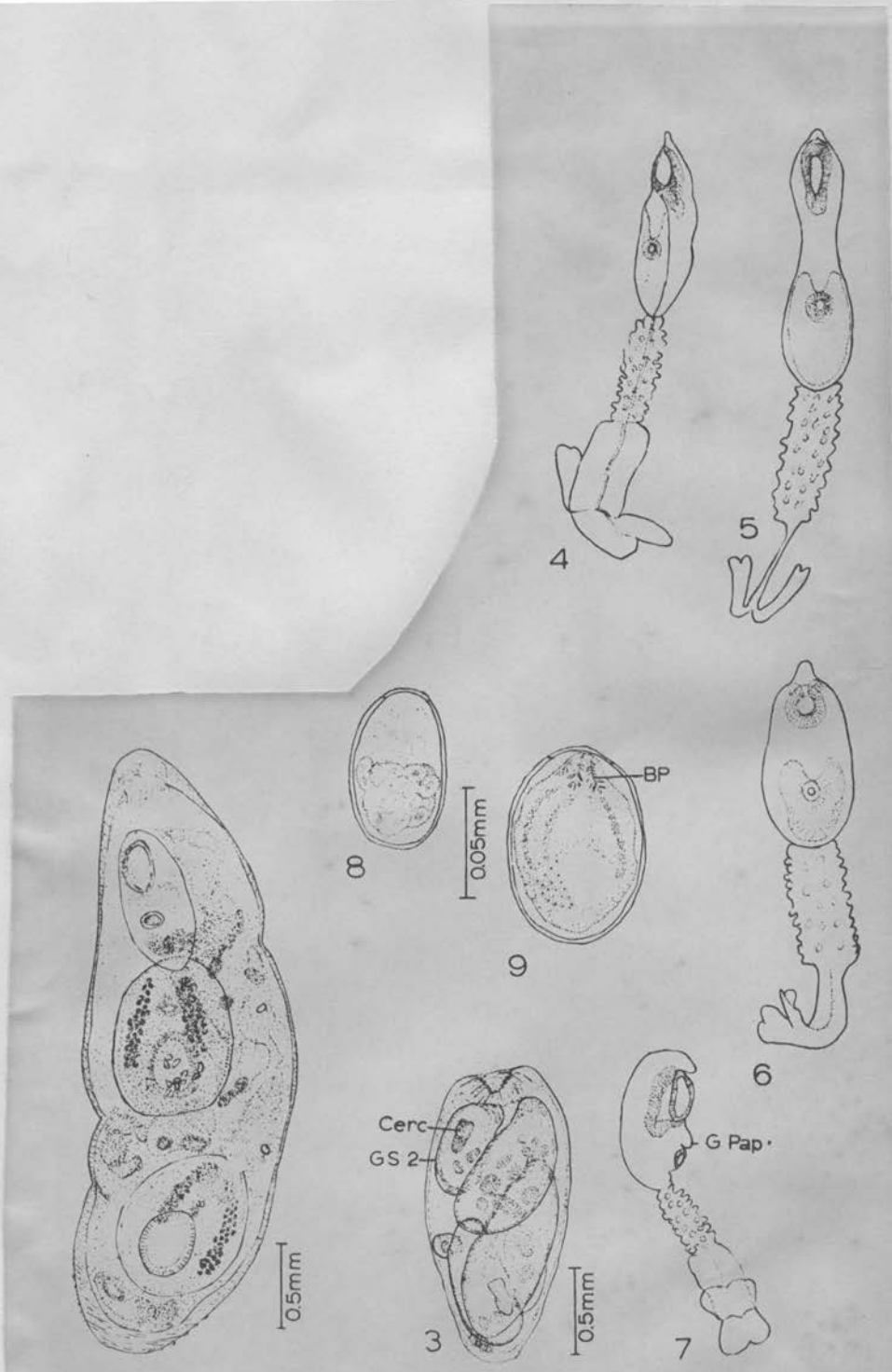
DISCUSSION

Proterometra dickermani n. sp. is the fifth species ascribed to the genus *Proterometra*, together with *P. macrostoma* (Faust) Horsfall 1933, *P. catenaria* Smith 1934, *P. hodgesiana* Smith (1932) 1936, and *P. sagittaria* Dickerman 1946. It most closely resembles *P. macrostoma*, but differs from the latter in several respects. Fully extended adults of *P. dickermani* are 2.6 mm. long and contract to 1.6 mm.; the corresponding measurements of *P. macrostoma* are 3.11 and 2.28 mm., respectively. The testes of *P. dickermani* are elliptical, those of *P. macrostoma* are ovoid. The uterus of *P. dickermani* has coils extending anterior to the posterior margin, often nearly reaching the anterior margin of the oral sucker; in *P. macrostoma* the anterior loop is at the level of the pharynx. In *P. dickermani* the vitellaria (Fig. 1, Vit) extend to, and sometimes beyond the posterior margin of the testes (Ts); in *P. macrostoma* the extent of the vitellaria is to the anterior half of the testes. The embryonated ova of *P. dickermani* definitely grow as they traverse the uterus (Figs. 8, 9), as described by Horsfall (1933, 1934) but denied by Dickerman (1934) for *P. macrostoma.*

The most striking difference between *P. dickermani* and any of the other species is in the degree of development of the cercariae. While still within the secondary germinal sacs, nearly 300 ova were present in the uterus, and the embryos in many (84 in one count) of the ova were active miracidia, becoming ciliated, ready for hatching miracidia. (Fig. 9). Dickerman's (1945) "Type I" of *P. macrostoma* has 30 to 50 eggs in the cercaria, a greater number than in the other "types" and previously described species. While studying the gametogenesis of *P. macrostoma* the present author (Anderson, 1935) found only early cleavage stages in such eggs.

The "distome body" of cercariae of *P. dickermani* has never been observed within the cavity of the tail, nor have cercariae been found to emerge from the snail hosts. During the study several thousand snails were subjected to the standard methods of isolation and observation for emergent cercariae. None of the cystocercous type of cercariae was found in this manner. Dickerman (1934) suggested that cercariae with the body outside of the tail cavity are immature, and implied that naturally emergent cercariae would always be mature and with the body enclosed. This concept can hardly be applied to *P. dickermani*, because the degree of reproductive development precludes the designation of "immature." Other peculiarities suggesting a unique life cycle in this species have been observed. These phenomena are being investigated and will be discussed in a later paper.

-OVER-



Proterometra dickermani, n. sp.

FIGS. 1–3. Drawn by tracing of microprojection; 8 and 9 by overlay of photomicrographs.
FIG. 1. Adult. G Pap, Genital papilla; Ts, Testis; Vit, Vitellarium; Ov, Ovary.
FIG. 2. Fully developed secondary germinal sac.
FIG. 3. Young primary germinal sac. Cerc, Cercarial embryo; GS2, Secondary germinal sac.
FIGS. 4–7. Views of cercariae in motion; drawn from freehand sketches of a living specimen. G Pap, Genital Papillae. (Internal details, including uterus with ova, omitted).
FIG. 8. Ovum removed from proximal (to oötype) portion of uterus.
FIG. 9. Ovum taken from uterus near genital atrium. BP, Bristle plate.

Proterometra hodgesiana Smith, 1932

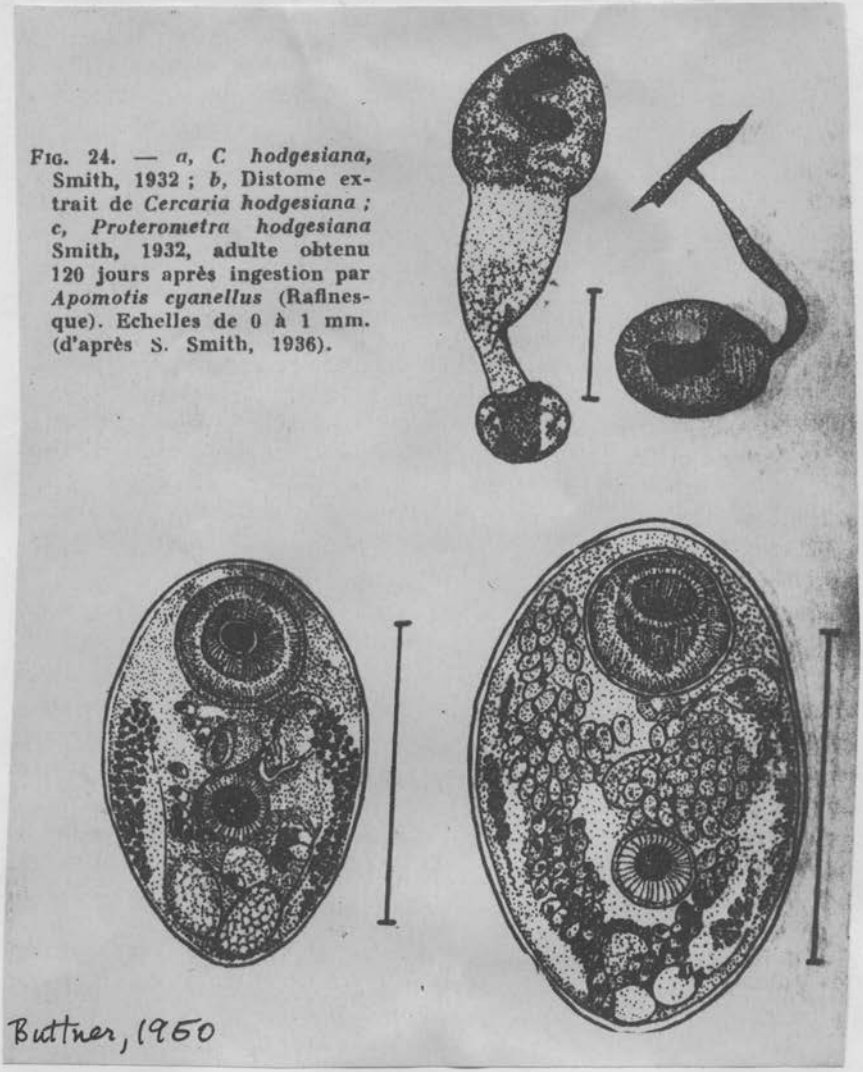


FIG. 24. — *a*, *C hodgesiana*, Smith, 1932 ; *b*, Distome extrait de *Cercaria hodgesiana* ; *c*, *Proterometra hodgesiana* Smith, 1932, adulte obtenu 120 jours après ingestion par *Apomotis cyanellus* (Rafinesque). Echelles de 0 à 1 mm. (d'après S. Smith, 1936).

Buttner, 1950

Proterometra sagittaria Dickerman, 1946
Experimental Host: sunfish, Eupomotis gibbosus ; Lake Erie

TABLE 2. Contrasting characters of *Proterometra macrostoma* (Faust) and *Proterometra sagittaria* n. sp.

Character	*P. macrostoma* (Faust)	*P. sagittaria* n. sp.
Color (in living condition):	Very light tan to pinkish	Orange
Musculature	Well developed	Very well developed
Gonads (Shape)	Ovoid	Elongate pyriform
Extent of Vitellaria	From posterior margin of oral sucker to anterior half of testes	From posterior margin of oral sucker to posterior half of testes, or beyond
Extent of Uterus	Anterior to the acetabulum a single loop arches from one side of the cirrus pouch up to the pharynx thence across to the opposite side and back to the genital papilla	Anterior to the acetabulum loose inter caecal coils extend anteriorly to the oral sucker, cross to the opposite side and then continue to the genital papilla
Size of Egg	0.082 by 0.049 mm.	0.072 by 0.0385 mm.
Cystogenous larva	*Cercaria macrostoma*	*Cercaria sagittaria*

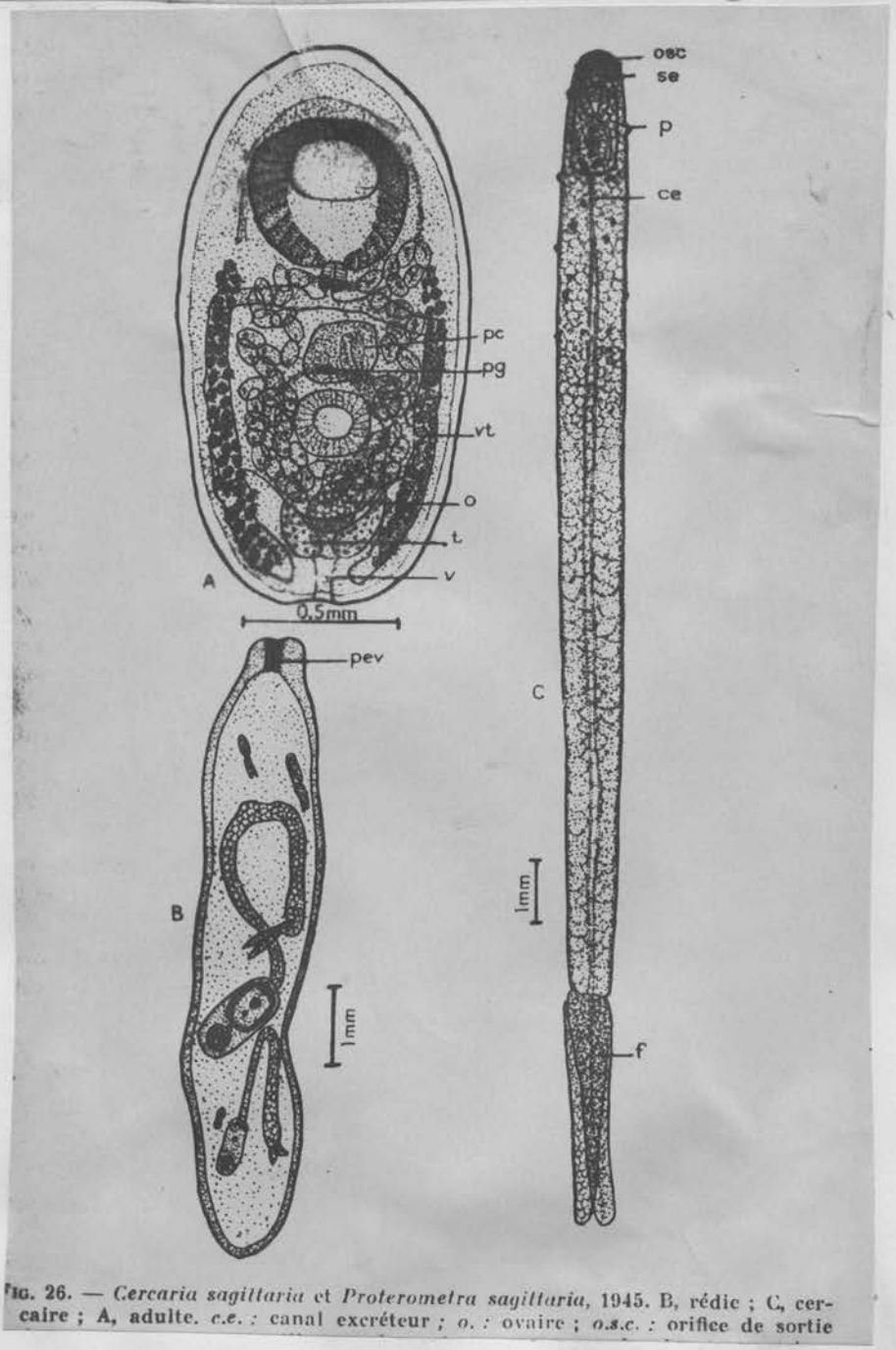


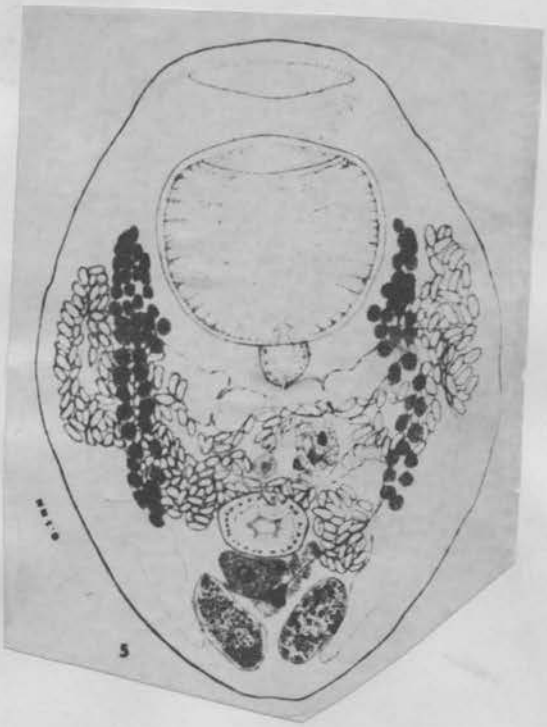
FIG. 26. — *Cercaria sagittaria* et *Proterometra sagittaria*, 1945. B, rédie ; C, cercaire ; A, adulte. *c.e.* : canal excréteur ; *o.* : ovaire ; *o.s.c.* : orifice de sortie

Proterometra septimae Anderson & Anderson, 1967

***Proterometra septimae* sp. n.**
(Figs. 5–7)

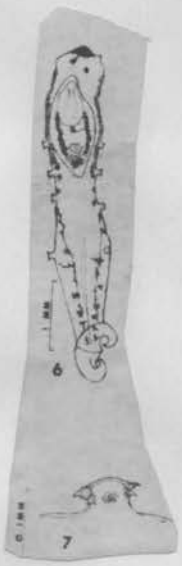
Adults (Fig. 5)

Living specimens pale orange; elliptical when extended, contracting to oval; oral sucker subterminal, opening anteriad; acetabulum approximately three-fourths of body length from anterior end; ratio of acetabulum to oral sucker diameter about 1:2.8, range 1:2.6 to 1:3.2. Fixed specimens oval; testes oblique to opposite, at posterior end of body, elliptical with long axes approximately 45° to each other, apex of angle posteriad, no significant difference in size; ovary median, wedged between anterior thirds of testes, oval or slightly lemniscoid; ootype directly posterior to ovary; vitellaria lateral, extending from level at center of oral sucker to level of center of acetabulum (in some specimens extend slightly less on one side of body than other); uterus with outermost longitudinal loops dorsal to lateral margins of intestinal ceca, anterior ends of loops extend to mid-level of oral sucker; slight increase in size of eggs during passage through uterus; embryos in eggs nearest atrium not yet showing miracidial form; genital atrium at anterior margin of acetabulum, not projecting over it.



Cercariae (Fig. 6)

Furcocystocercous; tail stem and furcae tan to golden brown with numerous irregular spots of opaque white pigment on posterior third of tail stem; furcae taper to point, curled in distinctive manner when at rest; anterior end of tail stem conical, base of cone with circlet of five papillae each projecting about 0.05 mm from surface and armed with six or seven pointed spines; four additional circlets of armed papillae, the largest of which (Fig. 7) project 0.01 mm from surface, located in a band extending between 1.7 and 3.1 mm from the anterior end; portion of tail stem posterior to band and furcae having numerous smaller papillae. Movement highly characteristic, consisting of vigorous swimming toward surface by flexing of tail stem with furcae straightened; downward drift with furcae curled; often resting on substrate between surfacing motions, during rest furcae curled, with weak, twitching flexions producing creeping movement over substrate. Distome in cavity generally close to anterior end, sometimes as much as one-third of tail stem length posteriad; differing from adult only in size and number of eggs *in utero*.



Germinal sacs

Two generations, no distinguishing differences from other species of *Proterometra*, body wall with some dark pigmentation.

Hosts: Adults in *Lepomis gibbosus* L. (experimental). Larvae in *Goniobasis catenaria* Say.

Locality: Holotypes from Blue Springs, Marianna, Jackson County, Florida; widely distributed in northern and central Florida and in southeastern Alabama.

Habitat: Adults in esophagus of fish. Larvae in gonoducts of snail.

Specimens deposited: USNM Helm. Coll. Nos. 61231 (adult, holotype) and 61232 (cercaria, paratype).

Azygiidae

PROTEROMETRA

Comparisons of three species

From Anderson & Anderson, 1967
J. Parasit.

TABLE I. *Measurements of species described. (All measurements given in millimeters).*

	Proterometra albacauda	*Proterometra septimae*	*Proterometra catenu*
Adults, living			
Length, extended	3.41	2.80	2.60
Length, contracted	1.67	1.55	1.49
Width, extended	0.59	0.62	0.46
Width, contracted	1.18	1.08	1.05
Oral sucker	0.59 × 0.59–0.77 × 0.43	0.62–0.68	0.62 × 0.62–0.71 × 0
Acetabulum	0.25 × 0.43–0.31 × 0.31	0.21–0.25	0.22–0.28
Adults, fixed			
Length	1.99–2.20	1.61–1.86	1.70–1.8
Width	1.23–1.38	1.15–1.27	1.18–1.3
Oral sucker	0.56 × 0.63–0.66 × 0.69	0.55 × 0.62–0.61 × 0.68	0.55 × 0.59–0.60 × 0
Acetabulum	0.29 × 0.33–0.33 × 0.37	0.19 × 0.23–0.22 × 0.25	0.17 × 0.24–0.19 × 0
Pharynx, diameter	0.011–0.012	0.013	0.012–0.014
Pharynx, length	0.010–0.011	0.013–0.014	0.011–0.013
Unbranched esophagus	0.01	0.02	0.011
Esophagus branches	0.22–0.27	0.12	0.19–0.22
Testis (1)	0.26 × 0.13–0.33 × 0.16	0.22 × 0.10–0.30 × 0.13	0.24 × 0.09–0.35 × 0
Testis (2)	0.19 × 0.11–0.28 × 0.14	0.22 × 0.10–0.30 × 0.13	0.22 × 0.11–0.27 × 0
Ovary	0.20–0.22 × 0.15	0.14 × 0.09–0.17 × 0.11	0.15 × 0.09–0.21 × 0
Smallest eggs	0.062 × 0.034	0.065 × 0.026	0.052 × 0.028
Largest eggs	0.075 × 0.042	0.073 × 0.36	0.059 × 0.034
Cercaria, living			
Tail stem, length	4.0–7.0	4.6–6.0	9.0–16.0
Tail stem, width	1.7–2.0	1.1–1.3	1.0–1.1
Furcae, length	1.5	0.9–1.1	1.6–2.5
Furcae, width	2.0	0.5 (at base)	0.5
Cercaria, fixed			
Tail stem, length	3.5–6.5	3.4–4.6	5.2–8.2
Tail stem, width	1.0–1.8	0.8–1.8	0.5–0.6 (anterior) 1.1–1.3 (maximum)
Furcae	0.75 × 1.2	0.7–0.9 long	1.0–1.3 long